Golder Associates Inc.
CONSULTING ENGINEERS

PRE-DESIGN INVESTIGATION
TASK A-2
GAS TREATABILITY
INTERIM FINAL REPORT
INDUSTRI-PLEX SITE
WOBURN, MASSACHUSETTS

Prepared for:

INDUSTRI-PLEX SITE REMEDIAL TRUST
800 North Lindbergh Boulevard
St. Louis, Missouri 63167

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October 1990 Project No. 893-6255

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Golder Associates Inc.
CONSULTING ENGINEERS

October 26, 1990 Project No. 893-6255

United States Environmental Protection Agency, Region 1
J.F.K. Federal Building HRS-CAN-3
Boston, Massachusetts 02203-2211

Attn: Joseph DeCola
Remedial Project Manager

RE: INDUSTRI-PLEX SITE PRE-DESIGN INVESTIGATION
TASK A-2 GAS TREATABILITY - INTERIM FINAL REPORT

Gentlemen:

On behalf of the Industri-Plex Site Remedial Trust, we are submitting the attached Gas Treatability Interim Final Report for the Industri-Plex Site in Woburn, Massachusetts. This report is being submitted in accordance with the Pre-Design Investigation Work Plan (PDI) Task A-2 reporting requirements (PDI Sections 3.5.4.5 and 3.8.1.4.2, p. 117 and 131).

Please contact us if you have any questions.

Very truly yours,

GOLDER ASSOCIATES INC.

Kenneth R. Moser, Associate
Project Manager

KRM/krm
C:2551026b

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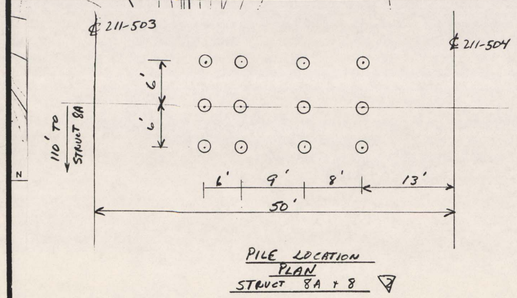
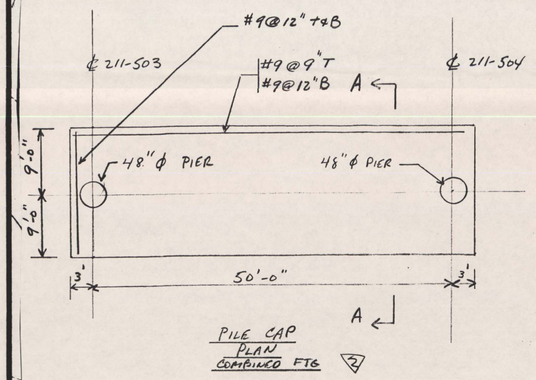
A. Ostrofsky, NUS
D. L. Baumgartner, ISRT
W. L. Smull, ISRT
J. Marmo, STV
G. Miller, H2M



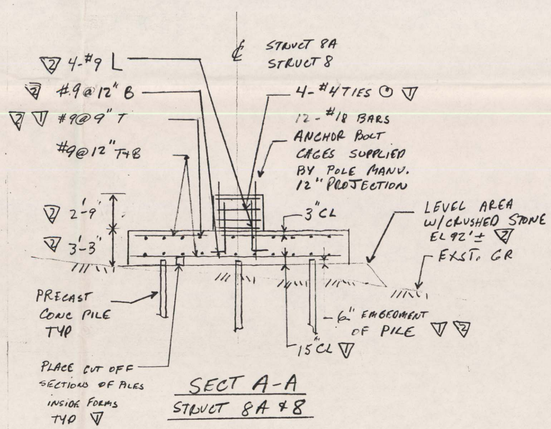
PILE LOCATION PLAN
STRUCT 8A + 8

NOTES:
1.) ALL PILES EXTEND 6" INTO CONC PILE CAP
2.) 70 TON PILE USED FOR CORROSION ALLOWANCE MAX LOAD IS 50 TONS
3.) PILES TO USE TYPE III CEMENT WITH 40% SLAG CEMENT MAX W/C RATIO = 0.40 2.5 IN REBAR COVER

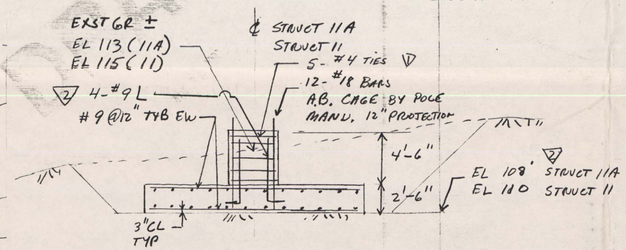
SPREAD FTG PLAN
STRUCT 11A + 11



PILE CAP PLAN
COMBINED FTG



SECT A-A
STRUCT 8A + 8



SECT B-B
STRUCT 11A + 11

CONCRETE NOTES:
1.) f_c' = 4000 PSI @ 28 DAYS
2.) F_y = 60,000 PSI
3.) ALL CONCRETE SHALL FOLLOW ACI SPECS

LEGEND

- PDI TASK S-2 BOREHOLE
- RI/FS BOREHOLE
- POWER POLE
- STREAM OR WATERCOURSE
- EDGE OF ROADWAY
- FENCES
- 120 CONTOUR
- MARSH

NOTES

1.) TOPOGRAPHIC MAP PREPARED BY SAIC ENGINEERING, INC., APRIL 15,1990.

S-9155A

FOUNDATIONS FOR STRUCTURES 8A, 8, 11A + 11
LINE 240-503/504 R/W 14
WOBURN INDUSTRI PLEX SITE
BOSTON EDISON COMPANY
JUNE 17, 1992 PF Barry
SEPT 9, 1992 REV PF Barry
OCT 5, 1992 REV PF Barry

DRAFT
AUG 30 1990

50 0 50 100
scale feet

REV	DATE	DESCRIPTION	DR BY	RVW BY

SCALE: AS SHOWN		PROJECT: INDUSTRI-PLEX SITE REMEDIAL TRUST WOBURN, MASSACHUSETTS
PROJECT No. 893-6255		
DES BY	RAC	08/21/90
DR BY	JSG	08/29/90
CHK BY		
RVW BY		

SHEET TITLE: BOREHOLE LOCATIONS EAST AND WEST HIDE PILES

Golder Associates
Mt. Laurel, New Jersey

SHEET OF
DRAWING No. MA01-105

H2MGROUP

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1.0 INTRODUCTION

1.1 Purpose

In accordance with Section 3.5.4.5 and 3.8.1.4.2 of the Pre-Design Work Plan (Golder Associates, 1989), the scope of this Interim Final Report is to present results of Task A-2, including a comparison of the results from the second round (August 1990) of East Hide Pile gas sampling with those from the first round (May 1990) and, if possible, make a correlation of gas emission rates with meteorological conditions. The purpose of this report is to provide sufficient detail to proceed with the design phase of a temporary gas treatment system for the East Hide Pile.

1.2 Consent Decree Objectives

The Consent Decree (USEPA, 1989a) entered between the Industri-Plex Site Remedial Trust (ISRT), the U.S. Environmental Protection Agency (USEPA), and the Massachusetts Department of Environmental Protection (MDEP) on April 24, 1989, incorporates the Remedial Design/Action Plan (RDAP, USEPA, 1989b) by reference and addresses Remedial Design/Remedial Action for the Industri-Plex Site in Woburn, Massachusetts. The location of the site is shown on Figures 1 and 2. The RDAP requires execution of the Pre-Design Investigation (PDI). The Pre-Design Work Plan (PDWP) outlines the tasks to be performed such that sufficient data are available to support design and implementation of the remedial actions specified in the Consent Decree.

The Record of Decision (ROD, USEPA, 1986a), the Consent Decree, and the RDAP present the details of the remedial actions.

These documents should be consulted for the details of each remedy. In general, the remedy for the East Hide Pile as stated in page 7 of the RDAP, includes the following:

> "The remedial action for control of air emissions is intended to mitigate the release or threat of release of Hazardous Substances, including odors associated with decaying hide waste, in the East Hide Pile.
>
> The remedial action shall consist of stabilizing the side slopes of the East Hide Pile, installing a gas collection layer, capping with a synthetic membrane to establish impermeability, and soil cover [in accordance with Attachment A], and treating gaseous emissions with either activated carbon or thermal oxidation..."

The objective of the PDI for the East Hide Pile gas treatability study (Task A-2) was "to provide data to assist in the development of the temporary gas treatment system to be operated at the East Hide Pile." A decision as to which gas treatment system will be chosen for the final treatment design has been deferred until the results of the monitoring study, to be conducted subsequent to installation of the impermeable barrier and gas collection system, can be fully evaluated.

2.0 RI/FS RESULTS

During the RI/FS (Stauffer 1984, 1985) emission rates from the East Hide Pile were measured using five bore hole locations. Detectable gas emissions from these locations ranged from 0.022 to 1.25 cubic feet per minute (CFM). The total gas emission rate measured was 1.82 CFM. The RI estimated a design value of 5 scfm for total emissions from the East Hide Pile based upon bore hole measurements and data from municipal landfills.

Results for gas composition analysis yielded average concentrations for combustible gas, hydrogen sulfide, methyl mercaptan and trace volatile organics of 390,000, 14,000, 19 and 128 ppm, respectively.

3.0 DATA NEEDS AND RATIONALE

The rationale for performing the gas treatability study was to provide sufficient data to further evaluate the selected alternatives for a gas treatment system. Data needs include 1) emission rate data and 2) gas composition data. Because the data from the RI/RS are several years old and gas composition and emission rate might change through time, current data are needed. These data will form the basis for the interim remedial design. General design parameters include gas composition, gas emission rate and depth/surface area of the hide pile.

In addition to confirming emission rates and gas composition, gas rates were correlated with temperature and barometer pressure measured during two rounds of sampling. These data were used to investigate any relationship between meteorological conditions and the rate at which gas is vented from the East Hide Pile.

4.0 METHODS

4.1 Field Methods

H2M conducted a series of gas emission rate measurements and gas sampling/analyses using both the existing gas vents and flux chamber techniques. Data were collected in two rounds of field sampling, the first round in May 1990 (May 18th and 19th, 1990)

and a second round in August 1990 (August 21 and 22, 1990), in order to assess any seasonal variation and correlate emission rates with the varying meteorological conditions. Standard Operating Procedures for all field sampling activities are provided in Appendix A. Sampling locations are given on Figure 4.

Emission rates from the gas vents were measured by attaching a 30 gallon bag via stainless steel clamps to the exterior portion of the vent pipe. Perforations in the vent riser pipe extending above grade were sealed with duct tape. Emission rates were calculated by measuring the time it took to fill the bag. Results for both rounds are presented in Table 1. Surface emission rates were measured using a flux chamber. Ambient air at the ground surface at the 12 locations shown on figure 4 were screened with an OVA, PID and multigas meter in the hydrogen sulfide mode. Six locations were selected based upon screening results. The locations were spaced to cover the entire East Hide Pile including its summit and side slopes. The original six selected sample locations are indicated on Figure 4 by HP1, HP2, HP3, HP4, HP7 and HP9. Two of these locations (HP2 and HP7) were resampled during the second round.

At each location, the flux chamber was placed on top of the ground and dry ultra-pure sweep air was added. The time, sweep air rate, air temperature and "real time" exit gas concentrations were recorded (see Appendix B). The chamber was purged with four volumes of sweep air before sampling. Discrete grab samples were

collected from the exit port and analyzed at H2M Labs, Inc. (Melville, New York) for H_2S, methyl mercaptan, volatile organic compounds and methane. Field blanks were obtained by placing the flux chamber over a clean Teflon sheet in the field before sampling. A duplicate sample was collected from the flux chamber at HP2 during the first round.

A discrete sample for chemical analysis was also collected from gas vent B1. The sample was collected through a Teflon sampling line using a portable pump. The sample line was inserted through a hole into the base of the riser pipe. A duplicate sample was also collected at B1 and both were analyzed for H_2S, methyl mercaptan, volatile organic compounds and methane.

4.2 Laboratory Methods

Samples were analyzed by H2M Labs, Inc. (Melville, New York) using EPA Method T01-T02 for volatile organics, OSHA Method 26 for methyl mercaptan, NIOSH Method 126 for hydrogen sulfide and a methane method provided by H2M Labs. Laboratory SOPs are provided in Appendix A. Table 2 provides a summary of Task A-2 analyses. Laboratory QA/QC procedures are discussed in the QAPjP and include use of standard operating procedures for sample analysis, data reduction, and reporting; and specifications for instrument calibration, method blank, MS/MSD, duplicate sample, and laboratory control sample analysis.

5.0 RESULTS

The results for gas sample chemical analyses for round 1 and 2 are presented in Table 3 and Appendix C. The emission rates for both real time sampling (using field screening instruments) and discrete sampling (using analytical collection techniques) at the flux chamber were calculated based upon the gaseous concentrations measured, the surface area isolated (0.13 square meters) and the sweep air flow rate (5 liters per minute). The surface emission rate for each specific compound is equal to the compound concentration (ug/m^3) times air flow rate (m^3/min.) divided by surface area (m^2) isolated. Emission rates from the gas vent were calculated based upon measured gaseous concentrations and volumetric flow rates determined in the field. Emission rates for discrete samples (both flux chamber and gas vent) and "real time" field measurements are presented in Tables 4 and 5. Emission rates based on "real time" results were estimated using the average concentration as detected by the OVA and assuming that the bulk of the emissions was methane gas.

Methane results for discrete sampling ranged from <4 parts per million by volume (ppm_v) at HP1 to 240,000 ppm_v at gas vent B1. Hydrogen Sulfide results ranged from <4 to 2890 ppm.

Results for acetone, chlorobenzene, ethylbenzene, benzene, toluene, and dichlorobenzene ranged from <0.005 to 4.4 ppm. Chlorobenzene and ethylbenzene were detected at 0.043 and 0.030 ppm_v in B1 but were not detected in the duplicate. Similarly methane and acetone detected in HP2 were not detected its

duplicate. All results for the trip blank and field blank, with the exception of acetone in the round one field blank, were below their analytical detection limits (see Appendix C).

6.0 DATA QUALITY OBJECTIVES

The overall objectives of the Quality Assurance Program were that the samples and analytical results which are described in this report are precise, accurate, representative, comparable and complete. Results for precision and accuracy are included in Appendix C along with laboratory reports.

Accuracy was assessed by means of monitoring matrix spike recoveries for a minimum of 5 percent of the samples analyzed. Precision was assessed by analyzing duplicate samples and comparing their results to acceptable laboratory limits. All round 1 and 2 results, were within the control limits specified in the QAPjP for precision and accuracy except for methane and acetone results in HP2-Duplicate and methane, chlorobenzene and ethylbenzene, results in B1-duplicate.

Completeness was measured by comparing the amount of valid data that was actually obtained to the amount that was expected under normal conditions. The data base for both rounds of sampling was 100% complete for all primary samples and QC samples except first round trip blank. Trip blank for the first round was not complete for methane and methyl mercaptan analysis. A summary of planned versus actual numbers of samples are given in Table 2.

Representativeness was addressed by selecting sample locations which demonstrated highest emission rates during the first round of sampling. Additional samples were collected at the gas vent which demonstrated the highest total emission rate. Finally, comparability of results was achieved by utilizing EPA or NIOSH approved methods where possible for analyses. Results were reported in SCFM so that comparisons between RI/FS data and treatability data could be made.

7.0 DATA ASSESSMENT

Total emission rates for HP2 and HP7 of 8.93×10^{-7} and 6.74×10^{-7} scfm/ft^2 were 104 and 2.6 times lower, respectively, than the emission rates measured (927×10^{-7} and 17.2×10^{-7} scfm/ft^2) at these locations during the first round of sampling in May 1990.

Total bore hole emission rates were similar between the first and second rounds although first round results for B1 were slightly higher than for round two. Emission rates for B3 could not be determined since the riser had been broken off at the ground surface. As during round one, no noticeable emissions were detected at B4.

The average temperatures and pressures obtained for the first and second sampling periods were 54.41°F and 29.70 inches of Hg and 63.27°F and 30.21 inches of Hg, respectively. The high and low temperatures obtained during the first and second rounds were 58.53 and 46.25°F and 67.73 and 57.36°F, respectively. The high and low pressures recorded for rounds 1 and 2 were 29.8 and

29.6 inches of Hg and 30.29 and 30.14 inches of Hg, respectively. Therefore, the temperature was generally 10°F higher during the second round and the barometric pressure 0.5 inches of Hg higher. It appears that higher pressure systems (as during the second round) cause decreased surface emission rates while increasing gas vent emission rates. The slight overall increase in the gas vent emission rates during the second round may have been due to the increased resistances exhibited at the surface due to higher atmospheric pressures hence a tendency for the gas to move latterly toward the gas vents. Similarly, lower atmospheric pressures as exhibited during round one caused an increase in total surface emission rates while decreasing the total gas vent emission rate.

In order to characterize the composition of the emissions from the East Hide Pile, discrete samples were collected from gas vent B1. Results for these analyses indicated that emissions from the East Hide Pile were comprised of 24% methane, 0.28% hydrogen sulfide and <0.004% volatile organics. The other 75.7% is most likely comprised of carbon dioxide with smaller amounts of nitrogen, and oxygen gas as typically found at landfills.

Initial results for total estimated emission based on first round results for methane using flux chamber sampling did not account for additional gases such as carbon dioxide, nitrogen and oxygen. A more realistic total emission rate is needed for design of the gas collection and treatment system and can be obtained by multiplying the results for the first round by a

factor of 4.17. This factor was obtained by ratioing the percent of methane emissions determined at B1 to the total emission rate measured using a calibrated bag and stop watch. It was assumed that the composition of the East Hide Pile gas was homogeneous. Using the factor of 4.17, the total emission rates determined from using first round results for HP2 (worse case) and a sloped/unsloped sector approach using HP2 and HP7 as representative emissions would increase accordingly from 15 and 7.8 scfm to 62.6 and 32.5 scfm, respectively. Therefore, the design value for total emissions from the East Hide Pile would be 62.6 scfm.

8.0 CONCLUSIONS

Massachusetts Department of Environmental Protection (MDEP) does not set limits for methane, hydrogen sulfide or the total volatile organic compounds which are found in the East Hide Piles gas emissions. The ROD states that the National Ambient Air Quality Standards (NAAQS) are applicable to operations at the site. The MDEP requires that the best available control technology (BACT) be used. Therefore the gas treatment peformance requirements will be dictated by best available techology.

The recommended alternatives for remediating odor emissions at the Industri-Plex site given in the ROD involves stabilizing the East Hide Pile's slopes and installing an active gas collection system and flexible membrane liner. The collected gases are to be treated with either activated carbon or by

thermal oxidation. The two selected alternatives were assessed for effectiveness, implementability, projected system performance and operating parameters. Based on the data assembled here and the guidance of equipment vendors and the EPA handbook of "Control Technologies for Hazardous Air Pollutants" (USEPA 1986b), it is believed that a thermal oxidation unit with an auxiliary fuel source will be the most appropriate method of treating gas emissions from the East Hide Pile.

While carbon adsorption is effective for removing hydrogen sulfide, methyl mercaptan and most VOCs, it is relatively ineffective for removing methane gas. On the other hand, thermal oxidation typically reports hydrocarbon (including methane and sulfide) conversion efficiencies of 98% or better. Both technologies require total inlet VOC concentrations of <10,000 ppm and would require dilution of the hide pile gas. It should be noted that since neither Massachusetts nor the EPA regulate methane emissions, thermal oxidation may not be deemed necessary, if treatment of the odor causing compounds alone are the primary concern.

9.0 REFERENCES

Golder Associates, Inc. 1989. Pre-Design Work Plan, Revision 1, Industri-Plex Site, Woburn, MA, December 1989.

Stauffer, see Stauffer Chemical Company.

Stauffer Chemical Company, 1984, 1985. Woburn Environmental Studies, Phase II Report, Industri-Plex Site Woburn, MA.

USEPA, see U.S. Environmental Protection Agency.

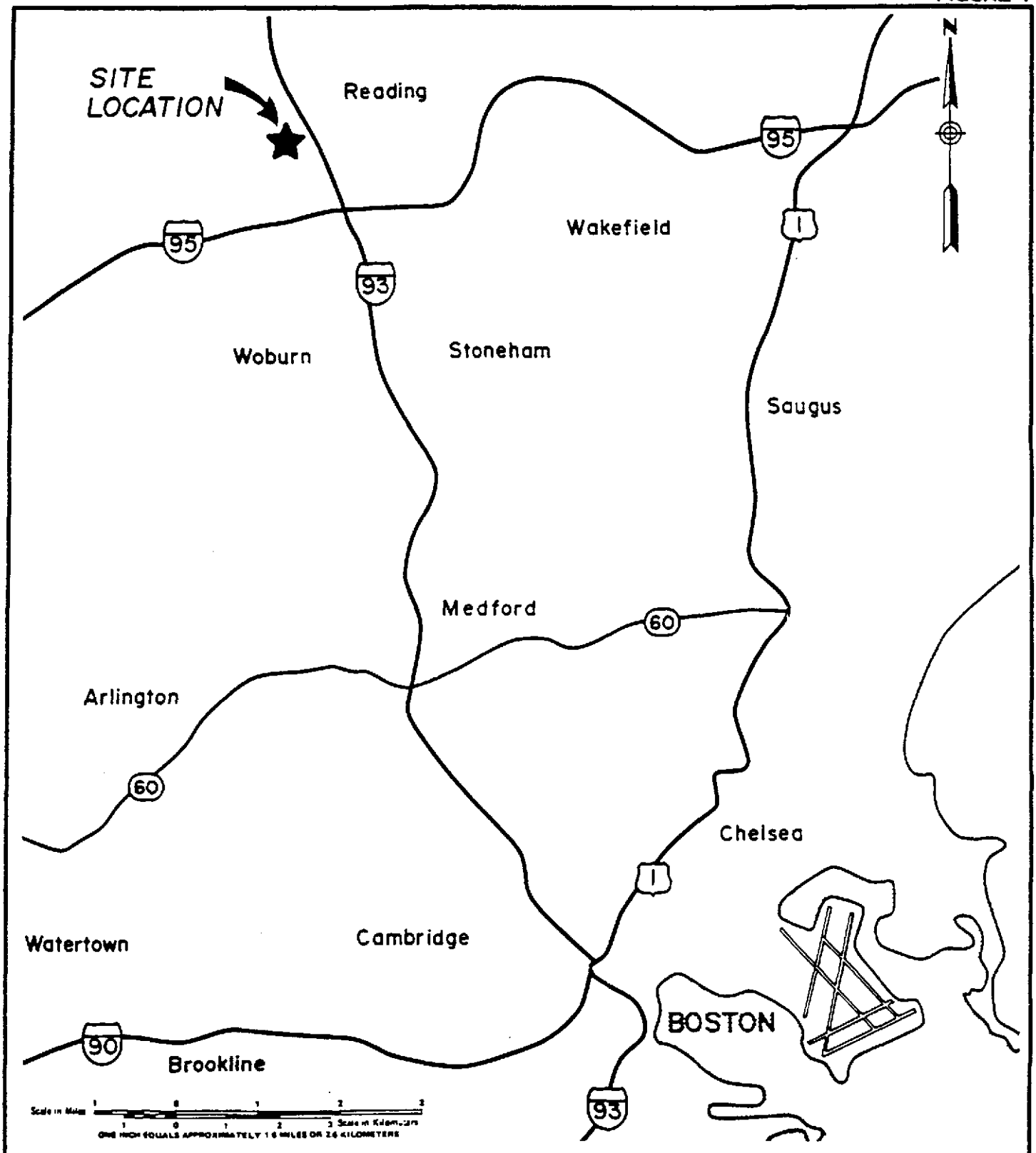
U.S. Environmental Protection Agency, 1986a. Record of Decision, Industri-Plex Site, Woburn, MA, September 1986.

U.S. Environmental Protection Agency, 1986b. Control Technologies for Hazardous Air Pollutants, Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, September 1986.

U.S. Environmental Protection Agency, 1986a. Industri-Plex Site Consent Decree, Civil Action 89-0196-MC, April 1989.

U.S. Environmental Protection Agency, 1989b. Remedial Design Action Plan, Industri-Plex Site, Woburn, MA.

FIGURE 1



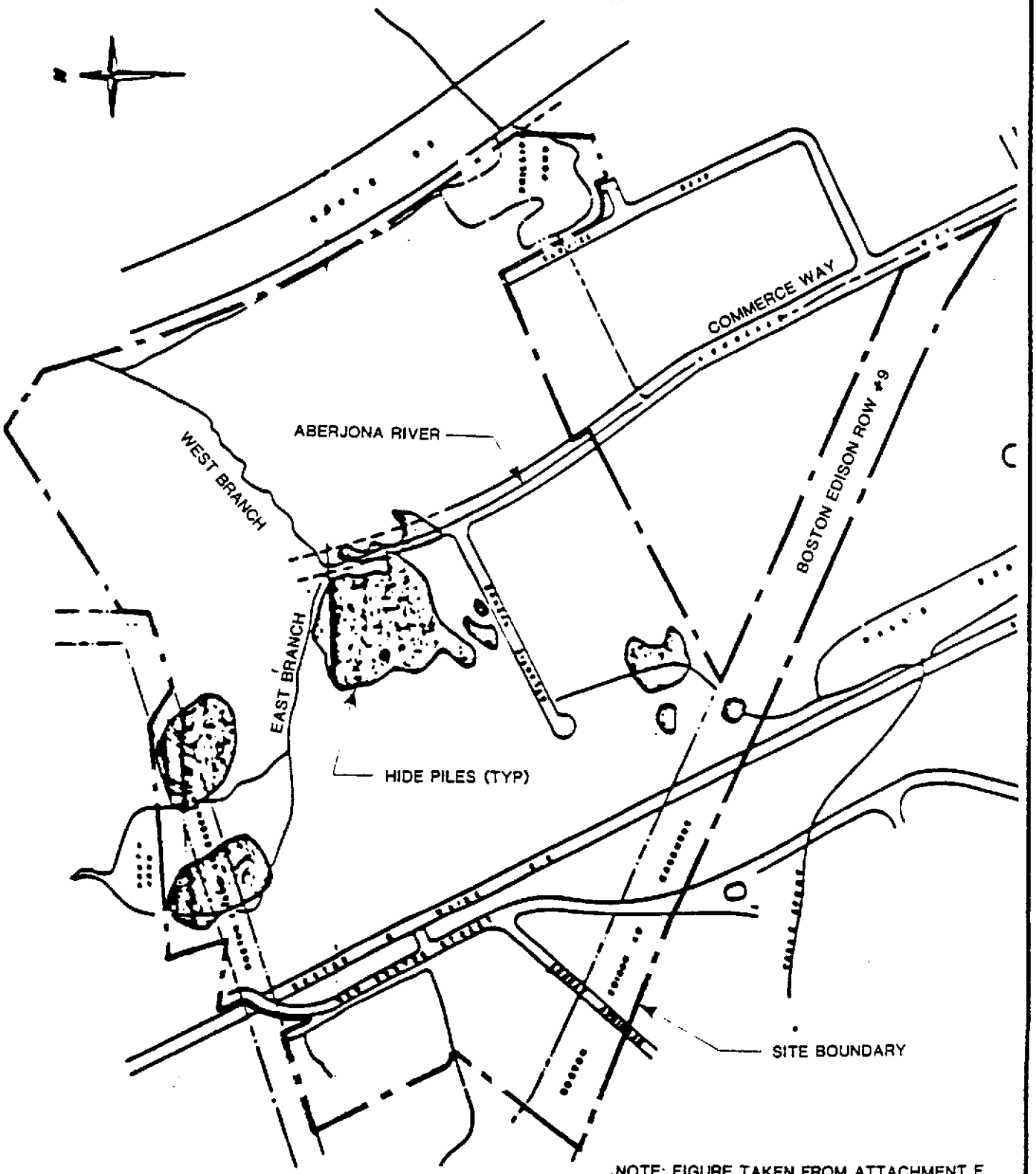
SITE LOCATION MAP

INDUSTRI-PLEX SITE, WOBURN, MA.

H2MGROUP ENGINEERS · ARCHITECTS · PLANNERS · SCIENTISTS · SURVEYORS
MELVILLE, N.Y. FAIRFIELD, N.J.

IPSR-89-01

FIGURE 2

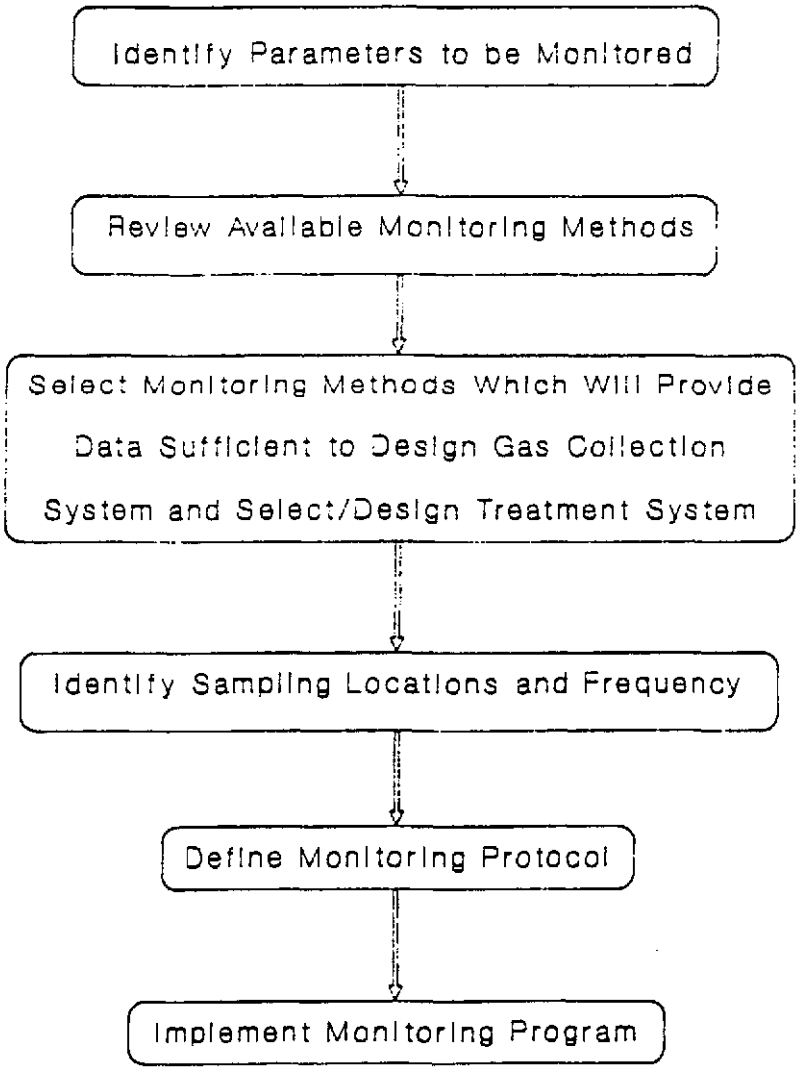


NOTE: FIGURE TAKEN FROM ATTACHMENT E FROM CONSENT DECREE

SITE BOUNDARY

INDUSTRI-PLEX SITE, WOBURN, MA.

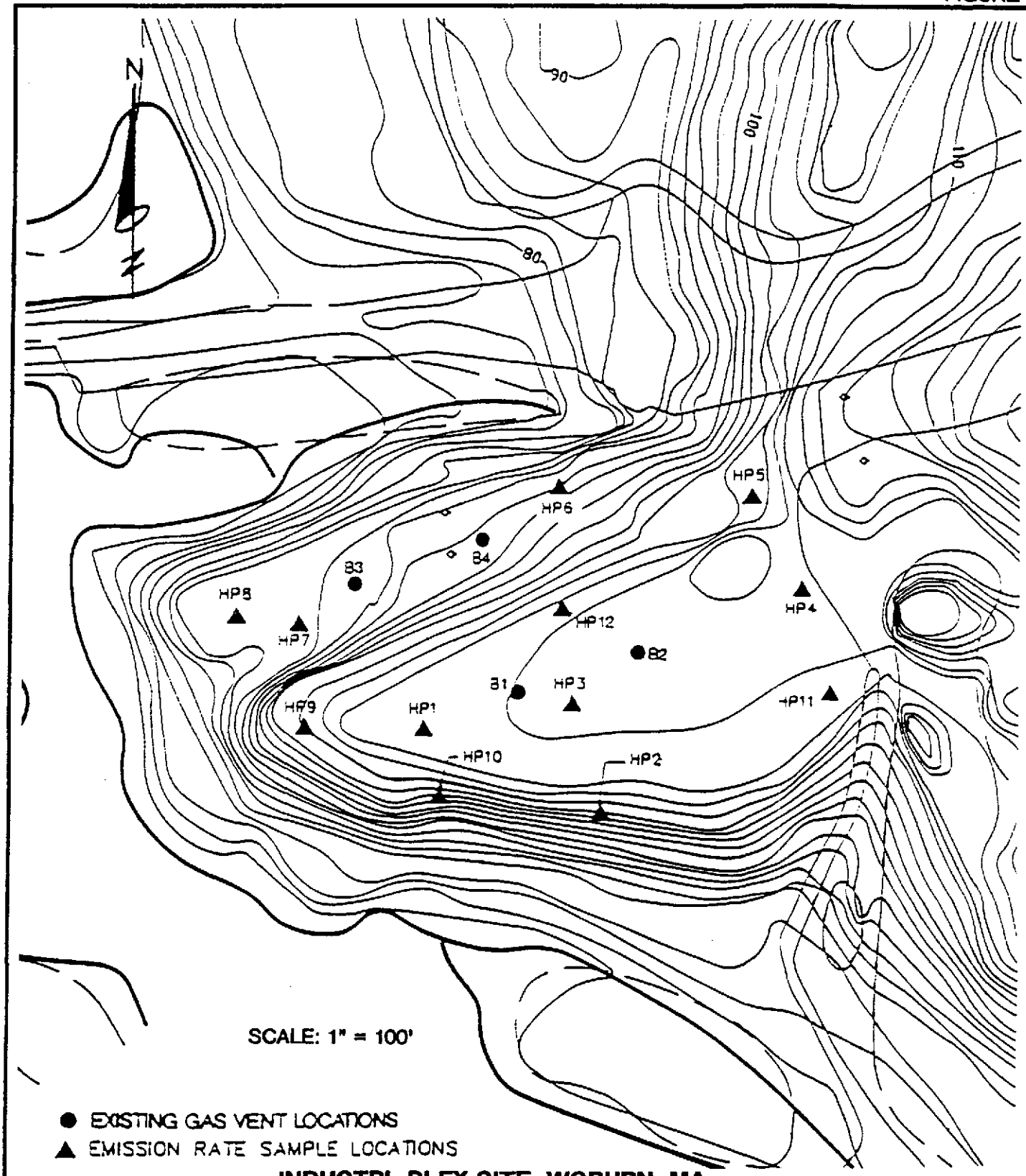
Collect Information to Design Temporary Gas Treatment System Including East Hide Pile Emission Rate(s), Gas Composition, Temporal Variations, and Trends



INDUSTRI-PLEX SITE, WOBURN, MA.

RATIONALE FOR ADDRESSING GAS TREATABILITY
PREDESIGN INVESTIGATION – TASK A-2

FIGURE 4



INDUSTRI-PLEX SITE, WOBURN, MA.

EAST HIDE PILE

GAS SAMPLING SITES

PREDESIGN INVESTIGATION – TASK A-2

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MELVILLE, N.Y. FAIRFIELD, N.J.

IPSR-89-01

TABLE 1
Results for East Hide Pile Gas Vent
Emission Rate Measurements

Location	Round 1 5/18/90 (scfm)	Round 2 8/21/90 (scfm)
B1	0.32	0.44
B2	0.091	0.033
B3	<0.002	NA
B4	0	0
Total	0.411 scfm	0.473 scfm

NA - Not Available

TABLE 2
Summary of Task A-2 Analyses

Analysis	Primary		Duplicate		MS/MSD's		Field Blanks		Trip Blanks	
	PDWP	Final	PDWP	Final	PDWP	Final	PDWP	Final	PDWP	Final
Volatile Organics	8	9	2	2	2	2	2	2	2	2
Methyl Mercaptan	8	9	2	2	2	2	2	2	2	1
Hydrogen Sulfide	8	9	2	2	2	2	2	2	2	2
Methane	8	9	2	2	2	2	2	2	2	1

TABLE 3
RESULTS FOR EAST HIDE PILE AIR SAMPLES

LOCATION	CH4 (ppmv)		H2S (ppmv)		CH3SH (ppmv)		ACETONE (ppmv)		BENZENE (ppmv)		TOLUENE (ppmv)		CHLOROBENZENE (ppmv)		ETHYLBENZENE (ppmv)		DICHLOROBENZENE (ppmv)	
	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG
HP1	<4	NA	<0.047	NA	<0.021	NA	<0.053	NA	<0.009	NA	<0.006	NA	<0.005	NA	<0.005	NA	<0.004	NA
HP2	760	7.3	<0.031	0.027	<0.021	<0.032	0.024	<0.009	<0.008	<0.007	<0.006	<0.006	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004
HP3	<4	NA	<0.008	NA	<0.006	NA	<0.010	NA	0.011	NA	<0.006	NA	<0.005	NA	<0.005	NA	<0.004	NA
HP4	8.3	NA	<0.031	NA	<0.021	NA	<0.010	NA	<0.006	NA	<0.007	NA	<0.005	NA	<0.005	NA	<0.004	NA
HP7	9.2	5.5	0.251	0.035	<0.021	<0.032	0.031	<0.010	<0.008	<0.006	<0.007	<0.006	<0.005	<0.005	<0.005	<0.005	<0.004	<0.004
HP9	38	NA	<0.031	NA	<0.021	NA	<0.010	NA	<0.008	NA	<0.007	NA	<0.005	NA	<0.005	NA	<0.004	NA
B1	NA	240000	NA	2760	NA	<0.185	NA	<0.009	NA	3.7	NA	3.2	NA	0.043	NA	0.030	NA	0.083
DUPLICATE HP2	<4	NA	<0.031	NA	<0.021	NA	<0.010	NA	<0.008	NA	<0.007	NA	<0.005	NA	<0.005	NA	<0.004	NA
DUPLICATE B1	NA	110000	NA	2890	NA	<0.195	NA	<0.010	NA	4.4	NA	3.2	NA	<0.006	NA	<0.006	NA	0.077
FIELD BLANK	<4	<5	<0.031	<0.027	<0.021	<0.032	0.84	<0.010	<0.008	<0.008	<0.007	<0.007	<0.005	<0.005	<0.005	<0.006	<0.004	<0.004
TRIP BLANK	NA	<5	<0.031	<0.027	NA	<0.032	<0.010	<0.010	<0.008	<0.008	<0.007	<0.007	<0.005	<0.005	<0.005	<0.006	<0.004	<0.004

NA - NOT ANALYZED

TABLE 4
COMPOUND SPECIFIC EMISSION RATES (SCFM/FT2)

LOCATION	CH4 X 10-7		H2S X 10-7		CH3SH X 10-7		ACETONE X 10-7		BENZENE X 10-7		TOLUENE X 10-7		CHLOROBENZENE X 10-7		ETHYLBENZENE X 10-7		DICHLOROBENZENE X 10-7	
	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG	MAY	AUG
HP1	<4.9	NA	<0.057	NA	<0.027	NA	0.364	NA	<0.010	NA	<0.008	NA	<0.006	NA	<0.006	NA	<0.005	NA
HP2	927	8.9	<0.038	0.03	<0.027	<0.05	0.029	<0.012	<0.010	<0.009	<0.008	<0.007	<0.006	<0.006	<0.006	<0.006	<0.005	<0.005
HP3	<4.9	NA	<0.010	NA	<0.008	NA	<0.013	NA	0.013	NA	<0.008	NA	<0.006	NA	<0.006	NA	<0.005	NA
HP4	10.1	NA	<0.038	NA	<0.027	NA	<0.013	NA	<0.010	NA	<0.008	NA	<0.006	NA	<0.006	NA	<0.005	NA
HP7	17.2	6.7	0.31	0.04	<0.027	<0.05	<0.038	<0.012	<0.010	<0.009	<0.008	<0.007	<0.006	<0.006	<0.006	<0.006	<0.005	<0.005
HP9	46	NA	<0.038	NA	<0.027	NA	<0.013	NA	<0.010	NA	<0.008	NA	<0.006	NA	<0.006	NA	<0.005	NA
B1	NA	1056000	NA	12144	NA	<0.814	NA	<0.012	NA	16.3	NA	14.1	NA	0.189	NA	0.132	NA	0.37
DUPLICATE HP2	<4.9	NA	<0.038	NA	<0.027	NA	<0.013	NA	<0.010	NA	<0.008	NA	<0.006	NA	<0.006	NA	<0.005	NA
DUPLICATE B1	NA	484000	NA	12716	NA	<0.814	NA	<0.05	NA	19.4	NA	14.1	NA	<0.03	NA	<0.03	NA	0.34
FIELD BLANK	<4.9	<6.1	<0.038	<0.04	<0.027	<0.04	0.103	<0.013	<0.010	<0.010	<0.009	<0.009	<0.006	<0.006	<0.007	<0.007	<0.005	<0.005
TRIP BLANK	NA	<6.1	<0.18	<0.04	NA	<0.04	<0.013	<0.013	<0.010	<0.010	<0.009	<0.009	<0.006	<0.006	<0.007	<0.007	<0.005	<0.005

NA - NOT ANALYZED

TABLE 5
Emission Rates Based on OVA Readings

Location	OVA Reading (ppm)		Total Emission Rate* ($X 10^{-7}$ (scfm/ft^2))	
	May	Aug	May	Aug
HP1	0.93	NA	1.1	NA
HP2	910	6.7	1100	8.1
HP3	1.2	NA	1.5	NA
HP4	4.2	NA	5.1	NA
HP5	8.4	4.5	10	4.8
HP9	55.2	NA	67	NA
B1	NA	>1,000	NA	>1220
Duplicate-HP2	880	NA	1100	NA
Duplicate-B1	NA	>1,000	NA	>1220
Field Blank**	5.2	0	6.3	0

NA - Not Analyzed

* - Total emissions were calculated as methane

** - Collected three feet above ground level at East Hide Pile

H2MGROUP

APPENDIX A

STANDARD OPERATING PROCEDURES

LIST OF PROCEDURES

H2M GROUP

- Standard Operating Procedure for Measuring Gas Emissions from Hide Pile
- Standard Operating Procedure for Field Monitoring CH_4 and H_2S in Air
- Standard Operating Procedure for Sampling Methyl Mercaptans in Air
- Standard Operating Procedure for Sampling Hydrogen Sulfide in Air
- Standard Operating Procedure for Sampling Methane in Air
- Standard Operating Procedure for Sampling Volatile Organics in Air
- Standard Operating Procedure for Analysis of Hydrogen Sulfide in Air (NIOSH Method #126)
- Standard Operating Procedure for Analysis of Methyl Mercaptan in Air (OSHA Method #26)
- Standard Operating Procedure for Methane Analysis
- Standard Operating Procedure for Determination of Volatile Organics in Air (Modified Method T01-T02)

STANDARD OPERATING PROCEDURE FOR MEASURING GAS EMISSIONS FROM HIDE PILE

1.0 - MATERIALS AND EQUIPMENT

1.1 Flux Chamber prepared in accordance with EPA Guidance Document #600/8-86/008.

1.2 Appropriately sized flexible tubing and clamps.

1.3 Field book and sheets.

1.4 Flexible bags.

1.5 Tape.

1.6 Cylinder of ultra pure air and gas flow regulator.

2.0 - PROCEDURE

Samples can only be collected when sample site is under positive pressure. It will be assumed that this condition exists Hardware and fittings are leak checked and certified by the manufacturer.

2.1 Insert flux box into the surface of the sampling site.

2.2 Adjust regulator to 5 liter/min.

2.3 Flush four (4) standing volumes using ultra pure sweep air.. Volume under sphere is approximately 2 cubic feet.

2.4 Attach OVA to exit port and record concentration, sweep air rate and temperature approximately every 6 minutes.

2.5 Calculate REAL TIME EMISSIONS by multiplying measured concentrations in ppm by the sweep air rate and dividing by surface area isolated.

2.6 For monitoring emissions from existing gas borings attach a flexible bag over well opening and seal with stainless steel clamp. Cinch, remove and seal bag after an appropriate sampling time.

STANDARD OPERATING PROCEDURE FOR FIELD MONITORING OF EXPLOSIVE GAS AND HYDROGEN SULFIDE IN AIR

1.0 - EQUIPMENT

1.1 Neotronic's EXOTOX50 Model No. 50 OFCH Portable 4 gas monitor.

1.2 Field book and sheets.

2.0 - PROCEDURES

2.1 Before using instrument check calibration. Calibration and performance checks must be performed per manufacturer's instructions once every three months, and the instrument calibrated by qualified personnel once a year.

2.2 Prior to using the instrument in the field, check that the battery has been fully charged. A battery exhaustion alarm will sound ten minutes or more after the battery warning is displayed. In the event of a battery exhaustion alarm, switch EXOTOX off and leave hazardous area. Immediately recharge or replace the battery in a safe area.

2.3 Switch instrument on by firmly pressing power button. The instrument will go through a series of self tests. Use the select button to obtain the appropriate setting per manufacturer's instructions. The instrument is capable of monitoring hydrogen sulfide in the range of 0 to 500 ppm and 0 to 100 percent explosive gas as % LEL methane.

2.4 Preset alarm settings for hydrogen sulfide are 50, 20, 10 ppm for ten minute peak (real time), STEL and TWA displays, respectively. Alarm setting for explosive gas is 20% LEL methane in air. The operator in addition to monitoring his breathing zone and the time of sampling, will attach the probe to the flux box sample port and measure and record LEL and hydrogen sulfide concentrations contained in the box. These concentrations will be compared with results obtained through analytical procedures for samples collected during the same event.

STANDARD OPERATING PROCEDURE FOR SAMPLING METHYL MERCAPTANS IN AIR (Ref.: OSHA Method #26)

1.0 - EQUIPMENT AND MATERIALS

1.1 Portable field sampling pump (Model No. 224-PCXR3 from SKC, Inc.).

1.2 A.P. Buck's gas flow calibrator (flow meter) Model #M-5.

1.3 Filter cassette fitted with a 37 mm Gelman Type A glass fiber filter which has been soaked in a 5% aqueous solution of mercuric acetate as outlined in OSHA Method #26.

1.4 Chain-of-custody forms.

1.5 Field book and sheets

1.6 Flux box.

2.0 - PROCEDURE

2.1 Flush four (4) standing volumes from flux box while monitoring temperatures, sweep air rate and OVA readings.

2.2 Allow readings to stabilize and record temperatures.

2.3 Calibrate pump with flow meter and cassette in line per manufacturer's instructions.

2.4 Attach filter cassette to flux box sample port.

2.5 Leak test system by placing toggle valve in line and measuring flow at the end of sample train when valve is closed. Flow should go to zero.

2.6 With flow meter in line open valve continue sampling until 20 liters are collected. Continue monitoring flow rates and record. An average flow rate will be used to determine final sample volume.

2.7 Store samples in small glass jar labeled appropriately with sample location, date, time, in accordance with procedures outlined in QAPjP.

2.8 Wrap each jar individually with bubble wrap and place in a cooler for transport to laboratory. Secure cooler with sufficient packing tape and a custody seal.

STANDARD OPERATING PROCEDURE FOR SAMPLING FOR HYDROGEN SULFIDE IN AIR (Ref.: NIOSH Method No. P1CAM126)

1.0 - EQUIPMENT AND MATERIALS

1.1 A.P. Buck's gas flow calibrator (flow meter) Model #M-5.

1.2 Portable field sampling pump able to deliver 2 lpm of sample.

1.3 Midget impinger filled with cadmium hydroxide solution and wrapped in aluminum foil.

1.4 Field book and sheets.

1.5 Chain-of-custody form.

1.6 Flux box.

2.0 - PROCEDURE

2.1 Calibrate pump with flow meter and midget impinger in line.

2.2 Evacuate four (4) volumes from flux box using method outlined in procedure for measuring gas emissions.

2.3 Connect impinger directly to flux box with appropriate flexible tubing and swagelok fittings as needed.

2.4 Leak test system by placing toggle valve in line and measuring flow at the end of sample train when valve is closed. Flow should go to zero.

2.5 Flow rate is monitored at regular intervals and recorded each time. Total volume sampled is based upon the average flow rate multiplied by the sample time.

2.6 Plug stems and tape ground glass joint to secure top seal.

2.7 Fill out all appropriate chain-of-custody forms and records as outlined in the QAPjP.

2.8 Place samples in cooler with sufficient ice for transport to the laboratory. Secure cooler with sufficient packing tape and a custody seal.

2.9 Include two (2) blank impingers (fill, seal and transport). Analyze with other samples.

STANDARD OPERATING PROCEDURE FOR SAMPLING METHANE IN AIR

1.0 - EQUIPMENT AND MATERIALS

1.1 One liter Tedlar Bag.

1.2 Portable field sampling pump Model No. 224PCXR3 from SKC, Inc.

1.3 A.P. Buck's gas flow calibrator (flow meter) Model #M-5.

1.4 Flux box

1.5 Field book and sheets.

1.6 Chain-of-custody form.

2.0 - PROCEDURE

2.1 Evacuate four (4) standing volumes from flux box using method outlined in procedure for measuring gas emissions.

2.2 Allow pressure to stabilize to ambient and record pressure.

2.3 Calibrate pump with flow meter in line according to manufacturer's instructions.

2.4 Attach Tedlar bag to flux box sample port.

2.5 Leak test system by placing toggle valve in line and measuring flow at the end of sample train after valve is closed. Flow should go to zero.

2.6 Release toggle and fill bag.

2.7 Disconnect fitting, label and store bag in cooler with ice for transport to the laboratory as per QAPjP.

2.8 Fill out all appropriate chain-of-custody forms and records as outlined in the QAPjP.

2.9 Collect two (2) QA/QC samples (one trip blank and one field blank) to be compared with results for analyses taken after transport and storage. One trip blank bag filled with purified air at laboratory will accompany the air sample bags from the laboratory to the site and back. Field blank will be filled with ambient air on-site.

STANDARD OPERATING PROCEDURE FOR SAMPLING VOLATILE ORGANICS IN AIR (Modified Method T01-T02)

1.0 - EQUIPMENT AND MATERIALS

1.1 Sorbent tube/trap - glass tubes (40 mm ID x 203 mm long) packed with the following materials from tube inlet to tube outlet:

(a) Glass beads: 250 mg of 60 to 80 mesh.

(b) Tenax: 75 mg of 60 to 80 mesh TA.

(c) Ambersorb XE 340, 170 mg of 20 to 40 mesh.

(d) Charcoal (activated carbon): 75 mg of 60 to 80 mesh.

1.2 Portable field sampling pump (Model No. 224PCXR3 from SKC, Inc.).

1.3 A.P. Buck's gas flow calibrator (flow meter) Model #M-5.

1.4 Cole-Palmer teflon TFE needle flow regulation valve Model #J-6393-60.

1.5 Large 4 liter storage jars with 2 to 3 inches activated carbon.

1.6 Appropriate field data forms and log book.

1.7 Chain-of-custody form.

1.8 Flux box.

2.0 - PROCEDURE

2.1 Condition trap by heating sorbent tube to 350° C, while simultaneously passing nitrogen gas at 50 to 60 cc/minute through it. The trap is cooled while continuing to pass gas through it. Cooled traps are sealed in glass vials and stored in jars with activated carbon prior to field sampling.

2.2 Calibrate field pump by adjusting flow to 1.5 liters per minute with flow meter in line. Put pump into low flow operation by turning the adjustment screw three turns counter-clockwise. Individual trap sampling flow is controlled by an in line valve which is adjusted accordingly during the sampling period.

2.3 Before sampling evacuate three (3) flux box volumes using portable field sampling pump and flow meter as outlined in emission rate procedure.

2.4 Sample volumes for each set of tubes connected in parallel are established based on estimated concentration for volatile organics using a portable photoionization detector (PID). If concentrations exceed 5 ppm for a 1 liter sample, scale sample volume down accordingly (i.e., for a 10 ppm reading sample 500 ml).

2.5 Attach sorbent tubes to sampling port on top of flux box using appropriate swagelok fittings.

2.6 Assemble remainder of sampling train down flow from sorbent tubes in the following fashion: using rubber tubing of appropriate ID, attach flow regulation valve in line to sorbent tube. Next, attach flow meter in line to valve. Portable sampling pump is attached in line to flow meter, completing the sampling train.

2.7 Leak test system by placing toggle valve in line and measuring flow at the end of sample train after valve is closed. Flow should go to zero.

2.8 Turn pump on and flow meter to start the sampling process. The sample time will be predetermined based on the screening done in Step 2.4 and the flow rate.

2.9 Continue to monitor flow rate and record. At the end of the sampling period, an average flow rate is obtained and multiplied by the time sampled to obtain total volume sampled.

2.10 Insert sorbent tube into individual vials and store in jar with activated carbon. Place jar in cooler with ice for transport back to laboratory according to chain-of-custody procedures given in the QAPjP.

2.11 Collect two (2) QA/QC samples (one trip blank and one field blank) to be compared with results for analyses taken after transport and storage. One trip blank conditioned in the lab will accompany sample traps to and from the field. Field blank will be prepared by pumping ambient air through trap on-site.

HYDROGEN SULFIDE IN AIR

Physical and Chemical Analysis Branch

Analytical Method

Analyte:	Hydrogen Sulfide	Method No.:	P&CAM 126
Matrix:	Air	Range:	0.008 ppm – 50 ppm
Procedure:	Absorption – Methylene Blue – Spectrophotometric	Precision:	Unknown
		Classification:	C (Tentative)
Date Issued:	6/9/72		
Date Revised:	1/15/74		

1. Principle of the Method

1.1 Hydrogen sulfide is collected by aspirating a measured volume of air through an alkaline suspension of cadmium hydroxide (Reference 11.1). The sulfide is precipitated as cadmium sulfide to prevent air oxidation of the sulfide which occurs rapidly in an aqueous alkaline solution. STRactan 10® is added to the cadmium hydroxide slurry to minimize photo-decomposition of the precipitated cadmium sulfide (Reference 11.2). The collected sulfide is subsequently determined by spectrophotometric measurement of the methylene blue produced by the reaction of the sulfide with a strongly acid solution of N, N-dimethyl-p-phenylenediamine and ferric chloride (References 11.3, 11.4, 11.5). The analysis should be completed within 24-26 hours following collection of the sample.

1.2 Hydrogen sulfide may be present in the open atmosphere at concentrations of a few ppb or less. The reported odor detection threshold is in the 0.7-8.4 $\mu g/m^3$ (0.5-6.0 ppb) range (References 11.6, 11.7). Concentrations in excess of 140 $\mu g/m^3$ (100 ppb) are seldom encountered in the atmosphere.

1.3 Collection efficiency is variable below 10 $\mu g/m^3$ and is affected by the type of scrubber, the size of the gas bubbles and the contact time with the absorbing solution and the concentration of H_2S (References 11.8, 11.9, 11.10).

2. Range and Sensitivity

2.1 This method is intended to provide a measure of hydrogen sulfide in the range of 1.1-100 mg/m^3. For concentrations above 70 mg/m^3 the sampling period can be reduced or the liquid volume increased either before or after aspirating. (This

method is also useful for the mg/m^3 range of source emissions. For example, 100 mℓ cadmium $(OH)_2$ STRactan 10® media in Greenberg-Smith impingers and 5 minute sampling periods have been used successfully for source sampling.) The minimum detectable amount of sulfide is 0.008 μg/mℓ, which is equivalent to 0.2 $\mu g/m^3$ in an air sample of 1 m^3 and using a final liquid volume of 25 mℓ. When sampling air at the maximum recommended rate of 1.5 ℓ/minute for 2 hours, the minimum detectable sulfide concentration is 1.1 $\mu g/m^3$ at 760 mm Hg and 25°C

2.2 Excellent results have been obtained by using this method for air samples having a hydrogen sulfide content in the range 5-50 ppm

3. Interferences

3.1 The methylene blue reaction is highly specific for sulfide at the low concentrations usually encountered in ambient air. Strong reducing agents (e.g., SO_2) inhibit color development. Even sulfide solutions containing several micrograms sulfide/mℓ show this effect and must be diluted to eliminate color inhibition. If sulfur dioxide is absorbed to give a sulfite concentration in excess of 10 μg/mℓ, color formation is retarded. Up to 40 μg/mℓ of this interference, however, can be overcome by adding 2-6 drops (0.5 mℓ/drop) of ferric chloride instead of a single drop for color development, and extending the reaction time to 50 minutes.

3.2 Nitrogen dioxide gives a pale yellow color with the sulfide reagents at 0.5 μg/mℓ or more. No interference is encountered when 0.3 ppm NO_2 is aspirated through a midget impinger containing a slurry of cadmium hydroxide-cadmium sulfide-STRactan 10®. If H_2S and NO_2 are simultaneously aspirated through cadmium hydroxide-STRactan 10® slurry, lower H_2S results are obtained, probably because of gas phase oxidation of the H_2S prior to precipitation as CdS (Reference 11.10).

3.3 Ozone at 57 ppb reduced the recovery of sulfide previously precipitated as CdS by 15 per cent (Reference 11.10).

3.4 Sulfides in solution are oxidized by oxygen from the atmosphere unless inhibitors such as cadmium and STRactan 10® are present.

3.5 Substitution of other cation precipitants for the cadmium in the absorbent (i.e., zinc, mercury, etc.) will shift or eliminate the absorbance maximum of the solution upon addition of the acid-amine reagent.

3.6 Cadmium sulfide decomposes significantly when exposed to light unless protected by the addition of 1 per cent STRactan® to the absorbing solution prior to sampling (Reference 11.2).

3.7 The choice of impinger used to trap H_2S with the $Cd(OH)_2$ slurry is very important when measuring concentration in the range 5-50 ppm. Impingers or bubblers having fritted-end gas delivery tubes are a problem source if the sulfide in solution is oxidized by oxygen from the atmosphere to free sulfur. The sulfur collects on the fritted-glass membrane and may significantly change the flow rate of the air sample through the system. One way of avoiding this problem is to use a midget impinger with standard, glass-tapered tips.

4. Precision and Accuracy

4.1 A relative standard deviation of 3.5 per cent and a recovery of 80 per cent has been established with hydrogen sulfide permeation tubes (Reference 11.2).

5. Advantages and Disadvantages of the Method

5.1 Effect of Light and Storage – Disadvantage

5.1.1 Hydrogen sulfide is readily volatilized from aqueous solution when the pH is below 7.0. Alkaline, aqueous sulfide solutions are very unstable because sulfide ion is rapidly oxidized by exposure to the air.

5.1.2 Cadmium sulfide is not appreciably oxidized even when aspirated with pure oxygen in the dark. However, exposure of an impinger containing cadmium sulfide to laboratory or to more intense light sources produces an immediate and variable photo-decomposition. Losses of 50-90 per cent of added sulfide have been routinely reported by a number of laboratories. Even though the addition of STRactan 10® to the absorbing solution controls the photo-decomposition (Reference 11.2), it is necessary to protect the impinger from light at all times. This is achieved by the use of low actinic glass impingers, paint on the exterior of the impingers, or an aluminum foil wrapping.

6. Apparatus

6.1 Sampling Equipment. The sampling unit for the impinger collection method consists of the following components:

6.1.1 A graduated 25 mℓ midget impinger with a standard glass-tapered gas delivery tube containing the absorbing solution or reagent.

6.1.2 A pump suitable for delivering desired flow rates with a minimum capacity of 2 ℓpm through the impinger. The sampling pump is protected from splashover or water condensation by an adsorption tube loosely packed with a plug of glass wool and inserted between the exit arm of the impinger and the pump

6.1.3 An integrating volume meter such as a dry gas or wet test meter. The air meter must be capable of measuring the air flow within ±2 per cent. A wet or dry gas meter, with contacts on the 1-feet^3 or 10-l dial to record air volume, or a specially calibrated rotameter, is satisfactory. Instead of these, calibrated hypodermic needles may be used as critical orifices if the pump is capable of maintaining greater than 0.7 atmospheric pressure differential across the needle (Reference 11.11).

6.1.4 Thermometer.

6.1.5 Manometer.

6.1.6 Stopwatch.

6.2 Associated laboratory glassware.

6.3 Colorimeter with red filter or spectrophotometer at 670 nm.

6.4 Matched cells, 1 cm path length.

7. Reagents

All reagents must be ACS analytical reagent quality. Distilled water should conform to the ASTM Standards for Referee Reagent Water.

All reagents should be refrigerated when not in use.

7.1 Amine-sulfuric Acid Stock Solution. Add 50 mℓ concentrated sulfuric acid to 30 mℓ water and cool. Dissolve 1.2 g of N, N-dimethyl-p-phenylenediamine dihydrochloride (para-aminodimethylaniline) (redistilled if necessary) in the acid. Do not dilute. The stock solution may be stored indefinitely under refrigeration.

7.2 Amine Test Solution. Dilute 25 mℓ of the Stock Solution to 1 liter with 1:1 sulfuric acid.

7.3 Ferric Chloride Solution. Dissolve 100 g of ferric chloride, $FeCl_3 \cdot 6H_2O$, in water and dilute to 100 mℓ.

7.4 Ammonium Phosphate Solution. Dissolve 400 g of diammonium phosphate, $(NH_4)_2HPO_4$, in water and dilute to 1 liter.

7.5 STRactan 10®. (Arabinogalactan) Available from Chicago Scientific, Inc., 716 W. Irving Park Road, Bensenville, IL 60106.

7.6 **Absorbing Solution.** Dissolve 4.3 g of $3CdSO_4 \cdot 8H_2O$, and 0.3 g sodium hydroxide in separate portions of water. Mix and add 10 g STRactan 10® and dilute to 1 liter. Shake the resultant suspension vigorously before removing each aliquot. The STRactan®-cadmium hydroxide mixture should be freshly prepared. The solution is only stable for 3 to 5 days.

7.7 **H_2S Permeation Tube.** Prepare or purchase* a triple-walled or thick walled Teflon® permeation tube (References 11.10, 11.12, 11.13, 11.14, 11.15) which delivers hydrogen sulfide at a maximum rate of approximately 0.1 µg/minute at 25°C. This loss rate will produce a standard atmosphere containing 50 µg/m³ (36 ppb H_2S when the tube is swept with a 2 ℓ/minute air flow. Tubes having H_2S permeation rates in the range of 0.004-0.33 µg/minute will produce standard air concentrations in the realistic range of 1-90 µg/m³ H_2S with an air flow of 1.5 ℓ/min.

7.7.1 Concentrated, Standard Sulfide Solution

Transfer freshly boiled and cooled 0.1M NaOH to a liter volumetric flask. Flush with purified nitrogen to remove oxygen and adjust to volume. (Commercially available, compressed nitrogen contains trace quantities of oxygen in sufficient concentration to oxidize the small concentrations of sulfide contained in the standard and dilute standard sulfide standards. Trace quantities of oxygen should be removed by passing the stream of tank nitrogen through a Pyrex or quartz tube containing copper turnings heated to 400-450°C.) Immediately stopper the flask with a serum cap. Inject 300 mℓ of H_2S gas through the septum. Shake the flask. Withdraw measured volumes of standard solution with a 10 mℓ hypodermic syringe and fill the resulting void with an equal volume of nitrogen. Standardize with standard iodine and thiosulfate solution in an iodine flask under a nitrogen atmosphere to minimize air oxidation. The approximate concentration of the sulfide solution will be 440 µg sulfide/mℓ of solution. The exact concentration must be determined by iodine-thiosulfate standardization immediately prior to dilution.

For the most accurate results in the iodometric determination of sulfide in aqueous solution, the following general procedure is recommended:

1 Replace the oxygen from the flask by flushing with an inert gas such as carbon dioxide or nitrogen.

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*Available from Metronics, Inc., 3201 Porter Drive, Palo Alto, California 94304, or PolyScience Corp., 909 Pitner Avenue, Evanston, Illinois 60202.

2. Add an excess of standard iodine, acidify, and back titrate with standard thiosulfate and starch indicator (Reference 11.16).

7.7.2 Diluted Standard Sulfide Solution

Dilute 10 mℓ of the concentrated sulfide solution to 1 liter with freshly boiled, distilled water. Protect the boiled water under a nitrogen atmosphere while cooling. Transfer the deoxygenated water to a flask previously purged with nitrogen and immediately stopper the flask. This sulfide solution is unstable. Therefore, prepare this solution immediately prior to use. This test solution will contain approximately 4 μg sulfide/mℓ.

8. Procedure

8.1 Cleaning of Equipment. All glassware should be thoroughly cleaned, the following procedure is recommended:

8.1.1 Wash with a detergent and tap water solution followed by tap water and distilled water rinses.

8.1.2 Soak in 1:1 or concentrated nitric acid for 30 minutes and then follow with tap, distilled, and double distilled water rinses.

8.2 Collection and Shipping of Samples

8.2.1 Pipet 10 mℓ of the absorbing solution (Section 7.6) into the midget impinger. The addition of 5 mℓ of 95 per cent ethanol to the absorbing solution just prior to aspiration controls foaming for 2 hours (induced by the presence of STRactan 10®. In addition, 1 or 2 Teflon demister discs may be slipped up over the impinger air inlet tube to a height approximately 1-2" from the top of the tube.

8.2.2 Connect the impinger (via the absorption tube) to the vacuum pump with a short piece of flexible tubing. The air being sampled should not be passed through any tubing or other equipment before entering the impinger.

8.2.3 Turn on pump to begin sample collection. Care should be taken to measure the flow rate, time and/or volume as accurately as possible. The sample should be taken at a flow rate of 1.5 ℓpm.

8.2.4 After sampling, the impinger stem can be removed and cleaned. Tap the stem gently against the inside wall of the impinger bottle to recover as much of the sampling solution as possible. Wash the stem with a small amount (1-2 ml) of unused absorbing solution and add the wash to the impinger. Then the impinger is sealed with a hard, non-reactive stopper (preferably Teflon). Do not seal with rubber. The stoppers on the impingers should be tightly sealed to prevent leakage during shipping. If it is preferred to ship the impingers with the stems in, the outlets of the stem should be sealed with Parafilm or other non-rubber covers, and the ground glass joints should be sealed (i.e., taped) to secure the top tightly.

8.2.5 Care should be taken to minimize spillage or loss by evaporation at all times. Refrigerate samples if analysis cannot be done within a day.

8.2.6 Whenever possible, hand delivery of the samples is recommended. Otherwise, special impinger shipping cases designed by NIOSH should be used to ship the samples.

8.2.7 A "blank" impinger should be handled as the other samples (fill, seal and transport) except that no air is sampled through this impinger.

8.3 Analysis

8.3.1 Add 1.5 ml of the amine-test solution to the midget impinger through the air inlet tube and mix.

8.3.2 Add 1 drop of ferric chloride solution and mix. (*Note:* See Section 3.1 if SO_2 exceeds 10 µg/ml in the absorbing media.)

8.3.3 Transfer the solution to a 25 ml volumetric flask. Discharge the color due to the ferric ion by adding 1 drop ammonium phosphate solution. If the yellow color is not destroyed by 1 drop ammonium phosphate solution, continue dropwise addition until solution is decolorized. Make up to volume with distilled water and allow to stand for 30 minutes.

8.3.4 Prepare a zero reference solution in the same manner using a 10 ml volume of absorbing solution, through which no air has been aspirated.

8.3.5 Measure the absorbance of the color at 670 nm in a spectrophotometer or colorimeter set at 100 per cent transmission against the zero reference.

9. Calibration and Standards

9.1 Aqueous Sulfide

9.1.1 Place 10 mℓ of the absorbing solution in each of a series of 25 mℓ volumetric flasks and add the diluted standard sulfide solution, equivalent to 1, 2, 3, 4, and 5 μg of hydrogen sulfide to the different flasks.

9.1.2 Add 1.5 mℓ of amine-acid test solution to each flask and mix.

9.1.3 Add 1 drop of ferric chloride solution to each flask. Mix, make up to volume and allow to stand for 30 minutes.

9.1.4 Determine the absorbance in a spectrophotometer at 670 nm, against the sulfide-free reference solution.

9.1.5 Prepare a standard curve of absorbance vs. μg H_2S/mℓ.

9.2 Gaseous Sulfide. Commercially available permeation tubes containing liquefied hydrogen sulfide may be used to prepare calibration curves for use at the upper range of atmospheric concentration. Triple-walled tubes, drilled rod and micro bottles which deliver hydrogen sulfide within a minimum range of 0.1-1.2 μg/minute at 25°C have been prepared by Thomas (Reference 11.10); O'Keeffe (References 11.12, 11.13); Scaringelli (References 11.14, 11.15). Preferably the tubes should deliver hydrogen sulfide within a loss rate range of 0.003-0.28 μg/minute to provide realistic concentrations of H_2S (1.5-140 μg/m³, 1.1-100 ppb) without having to resort to a dilution system to prepare the concentration range required for determining the collection efficiency of midget impingers. Analyses of these known concentrations give calibration curves which simulate all of the operational conditions performed during the sampling and chemical procedure. This calibration curve includes the important correction for collection efficiency at various concentrations of hydrogen sulfide.

9.2.1 Prepare or obtain a Teflon® permeation tube that emits hydrogen sulfide at a rate of 0.1-0.2 μg/minute (0.07-0.14 μℓ/minute at standard conditions of 25°C and 1 atmosphere). A permeation tube with an effective length of 2-3 cm and a wall thickness of 0.318 cm will yield the desired permeation rate if held at a constant temperature of 25°C ± 0.1°C. Permeation tubes containing hydrogen sulfide are calibrated under a stream of dry nitrogen to prevent the precipitation of sulfur in the walls of the tube.

9.2.2 To prepare standard concentrations of hydrogen sulfide, assemble the apparatus consisting of a water-cooled condenser, constant temperature bath maintained at 25°C ±0.1°C cylinders containing pure dry nitrogen

and pure dry air with appropriate pressure regulators, needle valves and flow meters for the nitrogen and dry air, diluent-streams. The diluent gases are brought to temperature by passage through a 2-meter-long copper coil immersed in the water bath. Insert a calibrated permeation tube into the central tube of the condenser, maintained at the selected constant temperature by circulating water from the constant-temperature bath, and pass a stream of nitrogen over the tube at a fixed rate of approximately 50 mℓ/minute. Dilute this gas stream to obtain the desired concentration by varying the flow rate of the clean, dry air. This flow rate can normally be varied from 0.2-15 ℓ/minute. The flow rate of the sampling system determines the lower limit for the flow rate of the diluent gases. The flow rate of the nitrogen and the diluent air must be measured to an accuracy of 1-2 per cent. With a tube permeating hydrogen sulfide at a rate of 0.1 μℓ/minute, the range of concentration of hydrogen sulfide will be between 6-400 $\mu g/m^3$ (4-290 ppb), a generally satisfactory range for ambient air conditions. When higher concentrations are desired, calibrate and use longer permeation tubes.

9.2.3 Procedure for Preparing Simulated Calibration Curves

Obviously one can prepare a multitude of curves by selecting different combinations of sampling rate and sampling time. The following description represents a typical procedure for ambient air sampling of short duration, with a brief mention of a modification for 24 hour sampling.

1. The system is designed to provide an accurate measure of hydrogen sulfide in the 1.4-84 $\mu g/m^3$ (1-60 ppb) range. It can be easily modified to meet special needs.

2. The dynamic range of the colorimetric procedure fixes the total volume of the sample at 186 ℓ; then, to obtain linearity between the absorbance of the solution and the concentration of hydrogen sulfide in ppm, select a constant sampling time. This fixing of the sampling time is desirable also from a practical standpoint: In this case, select a sampling time of 120 minutes. Then to obtain a 186 ℓ sample of air requires a flow rate of 1.55 ℓ/minute. The concentration of standard H_2S in air is computed as follows:

$$C = \frac{P_r \times M}{(R + r)}$$

where:

C = Concentration of H_2S in ppm
P_r = Permeation rate in μg/minute
M = Reciprocal of vapor density, 0.719 μℓ/μg
R = Flow rate of diluent air, liter/minute
r = Flow rate of diluent nitrogen, liter/minute

3. The data for a typical calibration curve are listed in Table 1.

TABLE 1

TYPICAL CALIBRATION DATA

Concentrations H_2S, ppb	Amount of H_2S in μl/186 liters	Absorbance of Sample
1	.144	.010
5	.795	.056
10	1.44	.102
20	2.88	.205
30	4.32	.307
40	5.76	.410
50	7.96	.512
60	8.64	.615

4. A plot of the concentration of hydrogen sulfide in ppm (x – axis) against absorbance of the final solution (y – axis) will yield a straight line, the reciprocal of the slope of which is the factor for conversion of absorbance to ppm. This factor includes the correction for collection efficiency. Any deviation from the linearity at the lower concentration range indicates a change in collection efficiency of the sampling system. If the range of interest is below the dynamic range of the method the total volume of air collected should be increased to obtain sufficient color within the dynamic range of the colorimetric procedure. Also, once the calibration factor has been established under simulated conditions the conditions can be modified so that the concentration of H_2S is a simple multiple of the absorbance of the colored solution.

5. For long-term sampling of 24-hour duration, the conditions can be fixed to collect 1200 ℓ of sample in a larger volume of STRactan 10®-cadmium hydroxide. For example, for 24 hours at 0.83 ℓ/min, approximately 1200 ℓ of air are scrubbed. An aliquot representing 0.1 of the entire amount of sample is taken for the analysis.

6. The remainder of the analytical procedure is the same as described in the previous paragraph.

9.2.4 The permeation tubes must be stored in a wide-mouth glass bottle containing silica gel and solid sodium hydroxide to remove moisture and hydrogen sulfide. The storage bottle is immersed to two-thirds its depth in a constant temperature water bath in which the water is controlled at 25°C ±0.1°C.

Periodically, (every 2 weeks or less) the permeation tubes are removed and rapidly weighed on a semimicro balance (sensitivity ±0.01 mg) and then returned to the storage bottle. The weight loss is recorded. The tubes are ready for use when the rate of weight loss becomes constant (within ±2 per cent).

10. Calculations

10.1 Gaseous Sulfide

10.1.1 Determine the sample volume in liters from the gas meter or flow meter readings and time of sampling. Adjust volume to 760 mm mercury and 25°C (V_s).

10.1.2 Determine the concentration of H_2S in $\mu g/m^3$.

$$\mu g\ H_2S/m^3 = \mu g\ H_2S/V_s \times 10^{-3}$$

where:

$\mu g\ H_2S$ = micrograms hydrogen sulfide determined
10^{-3} = conversion factor, m^3/ℓ

10.2 Gaseous Sulfide from Aqueous Sulfide

10.2.1 Determine the sample volume (V) in liters from the gas meter or flow meter readings and time of sampling. Adjust volume to 760 mm mercury and 25°C (V_s), using the correction formula:

$$V_s = V \times \frac{P}{760} \times \frac{298}{(T + 273)}$$

where:

V_s = Volume of air in liters at standard conditions
V = Volume of air sampled in liters
P = Barometric pressure in mm Hg
T = Temperature of sample air in °C

10.2.2 Using the Beers-Law Standard curve of absorbance vs. $\mu g\ S^=$ ion, determine $\mu g\ S^=$ ion in the sampling impinger corresponding to its absorbance reading at 670 nm.

10.2.3 Calculate the concentration of H_2S in the aspirated volume of air using the formula:

$$ppm.\ H_2S = \frac{\mu g\ S^= \times 24.45}{V_s \times MW}$$

where:

$\mu g\ S^=$ = micrograms sulfide ion (Section 10.2.2)
24.45 = molar volume of an ideal gas at 25°C and 760 mm Hg
MW = mass of sulfide ion, 32.06

11. References

11.1 Jacobs, M.B., Braverman, M.M., and Hochheiser, S. "Ultramicro determination of sulfides in air." Anal. Chem. 29: 1349 (1957).

11.2 Ramesberger, W.L., and Adams, D.F. "Improvements in the collection of hydrogen sulfides in cadmium hydroxide suspension." Environ. Sci. & Tech. 3: 258 (1969).

11.3 Mecklenburg, W., and Rozenkranzer, R. "Colorimetric determination of hydrogen sulfide." A. Anorg. Chem. 86: 143 (1914).

11.4 Almy, L.H. "Estimation of hydrogen sulfide in proteinaceous food products." J. Am. Chem. Soc. 47: 1381 (1925).

11.5 Sheppard, S.E., and Hudson, J.H. "Determination of labile sulfide in gelatin and proteins." Ind. Eng. Chem., Anal. Ed. 2: 73 (1930).

METHYL MERCAPTAN

Method no.:	26
Matrix:	Air
Target concentration:	0.5 ppm (1.0 mg/m³)
OSHA PEL:	10 ppm (20 mg/m³)
Procedure:	Samples are collected on glass fiber filters impregnated with mercuric acetate. Methyl mercaptan is regenerated from the mercuric mercaptide, formed during sampling, by treatment with hydrochloric acid. The methyl mercaptan is extracted into methylene chloride and analyzed by gas chromatography with a flame photometric detector.
Recommended air volume:	20 L
Recommended sampling rate:	0.2 L/min
Detection limit of the overall procedure: (Based on a 20 L sample)	0.027 ppm (0.053 mg/m³)
Reliable quantitation limit: (Based on a 20 L sample)	0.027 ppm (0.053 mg/m³)
Standard error of estimate at the target concentration:	8.6% (Section 4.5)
Special requirements:	Samples should be protected from light until analyzed.
Status of method:	Sampling and analytical method which has been subjected to the established evaluation procedures of the Organic Methods Evaluation Branch.

Date: February, 1981 Chemist: Carl J. Elskamp

Organic Methods Evaluation Branch
OSHA Analytical Laboratory
Salt Lake City, Utah

1. General Discussion

1.1 Background

1.1.1. History of procedure

In the past, samples received at the OSHA laboratory for methyl mercaptan have been collected in bubblers containing an organic solvent, such as xylene, or on activated charcoal. Bubblers, besides being cumbersome to use in the field, are suspected to have low collection efficiencies for methyl mercaptan. From studies done at the OSHA laboratory, it was found that methyl mercaptan reacts in the presence of activated charcoal to form a disulfide. Thus, a better sampling device was needed.

Several sampling devices are mentioned in methods in the literature. One method involves collection in bubblers or impingers containing mercuric acetate in acetic acid and analysis by colorimetry (Ref. 5.1.). Another method describes an absorber tube containing glass wool wetted with a mercuric acetate solution and employs a similar analysis scheme (Ref. 5.2.). Filters impregnated with mercuric cyanide (Ref. 5.3.) or mercuric acetate (Ref. 5.4.) to form the nonvolatile mercuric mercaptide have also been used. Adsorbent tubes methods have been found to be unacceptable for methyl mercaptan. (Ref. 5.5.)

Since it offered the most advantages, the glass fiber filter impregnated with mercuric acetate was evaluated as a possible sampling device. Methylene chloride was recommended as the extraction solvent in the method (Ref. 5.4.). There were problems encountered in the analysis using methylene chloride. The vent tube on the flame photometric detector, which is made of aluminum, was constantly being plugged up. This is likely due to reaction of the vent tube with the combustion products of methylene chloride, i.e. hydrochloric acid, to form aluminum salt(s). Also, the methylene chloride seemed to easily form bubbles in the syringe. Other solvents such as toluene, ios-octane, and chloroform gave lower extraction efficiencies than methylene chloride. Although some precision may be lost using methylene chloride, it was found to be the best solvent of those tested. The plugged detector vent problem was overcome by constructing a glass vent that performed well throughout the evaluation.

The method also recommended using 20 mL of methylene chloride for extraction. It was found that by using 5 mL of methylene chloride comparable extraction efficiencies

were obtained, thus the detection limit was decreased by a factor of four.

The recommended flame photometric detector gives a non-linear response for sulfur compounds. The photoionization detector gives a linear response and possibly a better detection limit (Ref. 5.6.) but is not compatible with methylene chloride. The photoionization detector was successfully used to monitor the methyl mercaptan concentrations during breakthrough studies and sample generations since no methylene chloride was present.

The target concentration of 0.5 ppm (1.0 mg/m^3) was chosen because this level has been adopted by the American Conference of Governmental Industrial Hygienists (Ref. 5.7.) and proposed by the National Institute for Occupational Safety and Health (Ref. 5.8.). The current OSHA PEL is 10 ppm. This sampling and analytical procedure appears to also be acceptable for samples at or above the OSHA PEL.

1.1.2. Toxic effects (This section is for information only and should not be taken as the basis of OSHA policy).

It has been reported that methyl mercaptan exhibits a toxicity similar to, but less than that of hydrogen sulfide. Others have reported the toxicity of both compounds being the same. Methyl mercaptan affects the nervous system and can cause convulsions and narcosis. At high concentrations, it causes paralysis of the respiratory center. At lower levels, it produces pulmonary edema (Ref. 5.7.).

A fatal human exposure was described by Shults et.al. where a man emptying gas cylinders of methyl mercaptan was overexposed. He was found comatose at the worksite and was hospitalized. He developed acute hemolytic anemia and methemoglobineomia and remained in a deep coma until dying 28 days after the accident (Ref. 5.9.).

1.1.3. Exposure

Methyl mercaptan is extensively used in the synthesis of the amino acid methionine. It is also used as an intermediate in the manufacture of jet fuels, pesticides, fungicides, and plastics. It occurs naturally in the "sour" gas in West Texas, in coal tar, and in petroleum distillates (Ref. 5.10.). It is also produced in large amounts as a by-product in paper manufacturing and petroleum refining (Ref. 5.4.).

It is estimated that over 19,000 U.S. workers were exposed to methyl mercaptan between 1972 - 74 (Ref. 5.11.).

1.1.4. Physical properties - (Ref. 5.12. unless otherwise noted)

Molecular Formula:	CH_3SH
Molecular Weight:	48.11
Melting Point:	-123°C
Boiling Point:	6.2°C
Color:	Water-white below boiling point or colorless gas (Ref. 5.10.)
Specific Gravity:	0.8665 (20/4°C)
Vapor Pressure:	2259 mm Hg at 37.8°C
Flash Point:	0°F (open cup method)
Odor:	odor of rotten cabbage (Ref. 5.11.)
Explosive Limits:	3.9 to 21.8% (Ref. 5.10.)
Solubility:	23.30 g/L in water at 20°C (Ref. 5.11.) Soluble in alcohol, ether, petroleum naphtha (Ref. 5.10.)
Synonyms:	Methanethiol, Mercaptomethane, Methylsulfhydrate, Thiomethyl Alcohol.

1.2. Limit defining parameters

1.2.1. Detection limit of the analytical procedure.

The detection limit of the analytical procedure is 0.33 nanograms per injection. This is the amount of methyl mercaptan which will give a peak whose height is approximately five times the baseline noise. (Section 4.1.)

1.2.2. Detection limit of the overall procedure

The detection limit of the overall procedure is 1.06 µg per sample (0.027 ppm or 0.053 mg/m^3 for a 20 L sample). This is the amount of methyl mercaptan that can be recovered from the sampling device which is equivalent to the analytical detection limit. (Section 4.2.)

1.2.3. Reliable quantitation limit.

The reliable quantitation limit is the same as the detection limit of the overall procedure since the recovery is above 75% and is within ±25% at the 95% confidence limit. (Section 4.2.)

It must be recognized that the reliable quantitation limit and detection limits reported in the method are based upon optimization of the instrument for the smallest possible amount of analyte. When the target concentration of an analyte is exceptionally higher than these limits, they may not be attainable at the routine operating parameters. In this case the limits reported on analysis reports will be based on the operating parameters used during the analysis of the samples.

1.2.4. Sensitivity

The sensitivity is not a linear function on the flame photometric detector. The response can be fit to a second degree curve over a limited range or can be fit to a $\ln(\text{concentration})^2$ vs ln(area) relationship. (Section 4.3)

1.2.5. Recovery

The recovery of analyte from the collection medium must be 75% or greater. The average recovery from generated samples over the range of 0.5 to 2 times the target concentration is 89.7%. (Section 4.4)

1.2.6. Precision (Analytical method only)

The pooled coefficient of variation obtained from replicate determinations of analytical standards between 0.5 to 2 times the target concentration for the recommended air volume is 0.011. (Section 4.3.)

1.2.7. Precision (Overall procedure)

The precision at the 95% confidence level for the 15-day storage test is ±17.8%. (Section 4.5.) This includes an additional ±5% for sampling error. The overall procedure must provide results at the target concentration that are ±25% or better at the 95% confidence level.

1.3. Advantages

1.3.1. The sampling procedure is convenient.

1.3.2. The analytical procedure is quick, sensitive, and reproducible.

1.3.3. Reanalysis of samples is possible.

1.3.4. Samples are stable, even at room temperature.

1.4. Disadvantages

1.4.1. The amount of sample that can be taken is limited by the number of milligrams the filter will collect before breakthrough occurs.

1.4.2. The precision is limited by the reproducibility of the pressure drop across the filters. The pumps are usually calibrated for one filter only.

1.4.3. The samples must be protected from light until analyzed.

2. Sampling Procedure

2.1. Apparatus

2.1.1. Personal sampling pump: Calibrated personal sampling pump, the flowrate of which can be determined within 5% at the recommended flowrate.

2.1.2. Glass fiber filters impregnated with mercuric acetate: The filters are prepared by soaking 37-mm Gelman type A glass fiber filters (or equivalent) in a 5% (w/v) aqueous solution of mercuric acetate. The filters are allowed to dry, and then assembled in two-piece filter cassettes without backup pads. The filters may be yellowish in color, which does not seem to affect their collection efficiency.

2.2. Reagents

None required.

2.3. Sampling technique

2.3.1. Immediately before sampling, remove the plugs from the filter cassette.

2.3.2. Connect the cassette to the sampling pump with flexible tubing. Air being sampled should not pass through any hose or tubing before entering filter cassette.

2.3.3. The cassette is attached to the employee's shirt collar or within his breathing zone. The inlet must be in a downward position during sampling.

2.3.4. Replace the plugs in the filter cassette immediately after sampling.

2.3.5. Protect samples from light after sampling.

2.3.6. With each batch of samples, submit at least one blank filter for analysis. This filter should be subjected to exactly the same handling as the samples except no air is drawn through it.

2.3.7. Transport the samples to the lab for analysis.

2.3.8. If bulk samples are submitted for analysis, they should be transported in a separate container from air samples.

2.4. Breakthrough

2.4.1. An attempt was made to determine the breakthrough volume when sampling from an air stream containing 2.16 mg/m³ methyl mercaptan in air at 80% relative humidity. No breakthrough was obtained after sampling for 750 minutes at 0.23 L/min, which is equivalent to over 170 L, or 0.37 milligrams of methyl mercaptan.

2.4.2. Theoretically, the breakthrough volume could be decreased if the atmosphere being sampled contained a significant amount of mercaptans or compounds that would react with the mercuric acetate making the mercuric ions unavailable to react with the methyl mercaptan.

2.5. Extraction efficiency

2.5.1. The extraction efficiency for samples generated on the vapor generator over the range of 0.5 to 2 times the target concentration is 89.7%. (Section 4.4.)

2.5.2. The extraction efficiency may vary from one laboratory to another and also from one lot of filters to another.

2.6. Recommended air volume and sampling rate

2.6.1. The recommended air volume is 20 L.

2.6.2. The recommended sampling rate is 0.2 L/min.

2.7. Interferences

2.7.1. An interference study has been reported (Ref. 5.4.). The four potential interferences studied were hydrogen sulfide, dimethyl sulfide, dimethyl disulfide, and propylene. There were no differences in recoveries for samples collected with these interferences present at either high or low humidity except when dimethyl disulfide was present at high humidity. It was concluded that

additional methyl mercaptan was produced from the dimethyl disulfide in the presence of water vapor.

2.7.2. Suspected interferences should be listed on the sample data sheets.

2.8. Safety precautions

2.8.1. Sampling equipment should be attached on the employee in a manner that does not interfere with work performance.

2.8.2. Wear proper safety equipment dictated by the area in which sampling is performed.

2.8.3. To avoid possible exposure to mercuric acetate, which is very toxic, never disassemble the filter cassette.

3. Analytical Procedure

3.1. Apparatus

3.1.1. Gas chromatograph equipped with a flame photometric detector used in the sulfur mode.

3.1.2. A GC column capable of separating methyl mercaptan from methylene chloride and any interferences. The column used for validation studies was: 10 ft X 1/8 in stainless steel 20% SP2100, 0.1% CW 1500 on 80/100 Supelcoport.

3.1.3. An electronic integrator or some other suitable method of measuring peak areas.

3.1.4. Two-mL vials with Teflon-lined caps.

3.1.5. Gas syringe, 25-µL or other convenient size for standard preparations.

3.1.6. Microliter syringe, 2-µL or other convenient size for sample injections.

3.1.7. Separatory funnel, 30-mL.

3.1.8. Scintillation vials and caps.

3.1.9. Pipets or dispenser for the methylene chloride and hydrochloric acid.

3.2. Reagents

3.2.1. Chromatographic grade methylene chloride.

3.2.2. Lecture bottle of pure methyl mercaptan.

3.2.3. Hydrochloric acid, 25% in deionized water (v/v).

3.2.4. Purified GC grade nitrogen, hydrogen, air, and oxygen.

3.2.5. Aqueous solution of mercuric acetate (5% w/v).

3.3. Standard preparation (See Section 3.8. before proceeding)

3.3.1. Standards are prepared by injecting pure methyl mercaptan using a gas syringe into methylene chloride contained in a scintillation vial. The vial is immediately capped and then shaken for a few seconds. The methylene chloride is dispensed into the vial using the same pipet or dispenser as used for the samples.

3.3.2. Corrections must be made for temperature and pressure to calculate the standard concentration. Shown below is the calculation for a standard prepared by injecting 25.0 µL of methyl mercaptan into 5 mL (from same dispenser used for samples extractions) of methylene chloride. The atmospheric conditions were 640 mm Hg and 20°C.

$$\frac{25\ \mu L}{\text{sample}} \times \frac{640\ mm}{760\ mm} \times \frac{273°K}{(273+20)°K} \times \frac{\mu mole}{22.41\ \mu L^*} \times \frac{48.11\ \mu g}{\mu mole} = \frac{42.11\ \mu g}{\text{sample}}$$

*Molar volume at 760 mm Hg, 0°C

3.3.3. Standards are transferred to 2-mL vials and sealed with Teflon-lined caps.

3.4. Sample preparation

3.4.1. Twenty milliliters of 25% hydrochloric acid and 5 mL of methylene chloride are added to a 30-mL separatory funnel.

3.4.2. The sample filter is folded and inserted into the neck of the separation funnel, but not allowed to contact the liquid.

3.4.3. The filter is then pushed into the funnel with the stopper, which is seated in the same motion.

3.4.4. The funnel is shaken for 2 min without venting.

3.4.5. After the phases have separated, the methylene chloride is drained into a vial. The vial is then sealed with a Teflon-lined cap.

3.5. Analysis

3.5.1. GC Conditions

Flow Rates (mL/min)		Zone Temperatures (°C)	
Nitrogen (Carrier)	20	Column Oven	80
Hydrogen	150	Injector	150
Air	50	Detector	225
Oxygen	40		

Injection size	2.0 µL
Elution time	Methyl Mercaptan 1.6 min
Chromatogram	(Section 4.6.)

3.5.2. Peak areas are measured by an integrator or other suitable means.

3.5.3. A calibration curve is constructed from peak areas of standard injections. (Section 4.3.) Sample concentrations must be bracketed by standards.

3.6. Interferences

3.6.1. Any compound that has the same general retention time as methyl mercaptan and responds on the flame photometric detector (sulfur mode) is an interference. Possible interferences should be listed on the sample data sheets.

3.6.2. GC parameters (i.e. column temperature, column, etc.) may be changed to circumvent any interferences.

3.6.3. Retention time on a single column is not considered proof of chemical identity. Samples over the PEL should be confirmed by GC/Mass Spec or other suitable means.

3.7. Calculations

The methyl mercaptan concentration (µg/sample) is obtained from the calibration curve from section 3.5.3. The air concentration for samples is calculated using the following formulae.

$mg/m^3 = A/(B)(C)$ where A= µg/sample from curve
B= L of air sampled
C= Extraction efficiency

$ppm = (mg/m^3)(24.46)/48.11 = (mg/m^3)(0.5084)$

Where 48.11 = molecular weight of methyl mercaptan)
24.46 = molar volume at 760 mm Hg and 25°C

3.8. Safety precautions

3.8.1. Mercuric acetate is highly toxic by ingestion, inhalation, and skin absorption (Ref. 5.13.). All work with it should be done in a hood. After samples are extracted, dispose of the aqueous layer in a labeled waste bottle. Do not dispose of down a sink drain.

3.8.2. All work with methyl mercaptan standard preparations must be done in a hood. It is convenient to use a septum adapter for the lecture bottle. A length of flexible tubing is connected to the side vent of the adapter. The other end of the tubing is then placed in a beaker containing a solvent in which methyl mercaptan is soluble. The lecture bottle is then opened just far enough so bubbles are formed about 1 per 5 seconds. The beaker of solvent serves as a flow indicator as well as a partial trap for the methyl mercaptan. After standards are prepared the tubing is removed from the beaker of solvent and the lecture bottle is turned off. If the tubing is left in the solvent, the solvent will rise up the tube and enter the adapter. The solvent is then poured in a labeled waste bottle.

3.8.3. Extractions must be done in a hood. Avoid skin contact with solvents and sample filters.

3.8.4. Wear safety glasses and a lab coat at all times.

4. Backup Data

4.1. Detection limit

The detection limit of the analytical procedure was determined by making a 2.0 µL injection of a 0.167 µg/mL standard. The chromatogram is shown in Figure 4.1. This is equivalent to 0.834 µg per sample when using 5.0 mL of methylene chloride for extraction.

4.2. Detection limit of the overall procedure and reliable quantitation limit.

Detection limit samples were generated from a dry atmosphere containing approximately 1.0 mg/m^3 methyl mercaptan by sampling for 5 minutes at approximately 0.2 L/min. The amount of methyl mercaptan collected was near the analytical detection limit (0.834 µg per sample) for a sample extracted into 5.0 mL of methylene chloride.

Sample Number	Theoretical Amount (µg)	Amount Recovered (µg)	% Recovery
1	1.046	0.747	71.4
2	0.978	0.850	86.9
3	1.055	0.858	81.3
4	1.095	0.816	74.5
5	1.077	0.799	74.2
6	1.016	0.850	83.7
			$\bar{X}$ = 78.7
			SD = 6.17

Limit = 0.834/0.787 = 1.06 µg/sample

4.3. Sensitivity and analytical precision

Replicate injections of standards in the range of 0.5 to 2 times the target concentration were made. The data was fit to a second degree curve and a $\ln(\text{concentration})^2$ vs $\ln(\text{area})$ curve as shown in Figures 4.3.1. and 4.3.2. respectively.

µg/sample	µg/mL	Area Count	
10.43	2.09	450	
"	"	443	
"	"	446	$\bar{X}$ = 445.8
"	"	449	SD = 3.19
"	"	442	CV = 0.0072
"	"	445	
13.90	2.78	805	
"	"	811	
"	"	848	$\bar{X}$ = 818.8
"	"	820	SD = 15.51
"	"	809	CV = 0.0189
"	"	820	
20.86	4.17	1911	
"	"	1923	
"	"	1958	$\bar{X}$ = 1945.3
"	"	1965	SD = 22.47
"	"	1956	CV = 0.0116
"	"	1959	
41.71	8.34	7370	
"	"	7370	
"	"	7532	$\bar{X}$ = 7403.3
"	"	7344	SD = 66.98
"	"	7410	CV = 0.0090
"	"	7394	

$\overline{CV}$ = 0.011 (Pooled CV)

4.4. Recovery/extraction efficiency

Samples were generated from a dry atmosphere containing approximately 1.0 mg/m³ methyl mercaptan by sampling for 50, 100, and 200 minutes at approximately 0.2 L/min. These samples were equivalent to 0.5, 1.0, and 2.0 times the target concentration based on a recommended air volume of 20 L, respectively.

Concentration Level	Theoretical Amount (µg)	Recovered Amount (µg)	% Recovered
0.5 X	9.19	8.82	96.0
"	8.59	7.57	88.1
"	9.26	7.62	82.3
"	9.62	7.53	78.3
"	9.46	8.45	89.3
"	8.92	8.33	93.4
			$\bar{X}$ = 87.9
1.0 X	20.90	17.54	83.9
"	19.54	19.16	98.1
"	21.08	18.39	87.2
"	21.89	18.98	86.7
"	21.53	17.15	79.7
"	20.31	18.27	90.0
			$\bar{X}$ = 87.6
2.0 X	44.04	41.95	95.3
"	41.16	42.16	102.4
"	44.41	43.09	97.0
"	46.11	41.61	90.2
"	45.35	37.74	83.2
"	42.78	40.01	93.5
			$\bar{X}$ = 93.6
			$\bar{\bar{X}}$ = 89.7

4.5. Storage data

Samples were generated at the target concentration at 80% relative humidity. All samples were taken for 100 minutes at ~0.2 L/min. Six samples were analyzed immediately and fifteen samples each were stored at refrigerated (-5°C) and ambient temperatures protected from light. These samples were analyzed over a period of 15 days. The tabulated results below are shown graphically in Figures 4.5.1. and 4.5.2. The samples are stable over the 15-day storage period under both storage conditions.

Day Analyzed	Refrigerated	Ambient
0	89.8	89.8
0	78.3	78.3
0	88.5	88.5
0	90.6	90.6
0	76.1	76.1
0	86.6	86.6
3	81.1	83.1
3	76.0	100.9
3	96.7	76.5
6	80.0	78.3
6	88.6	77.4
6	92.3	86.3
9	93.4	69.9
9	85.2	89.5
9	86.4	84.1
12	77.4	86.7
12	86.0	87.3
12	82.3	82.6
15	92.3	86.9
15	86.0	87.4
15	91.4	78.0

4.6. Chromatogram

A typical chromatogram using the GC parameters as in section 3.5.1., is shown in Figure 4.6. The chromatogram is from a 4.2 µg/mL standard.

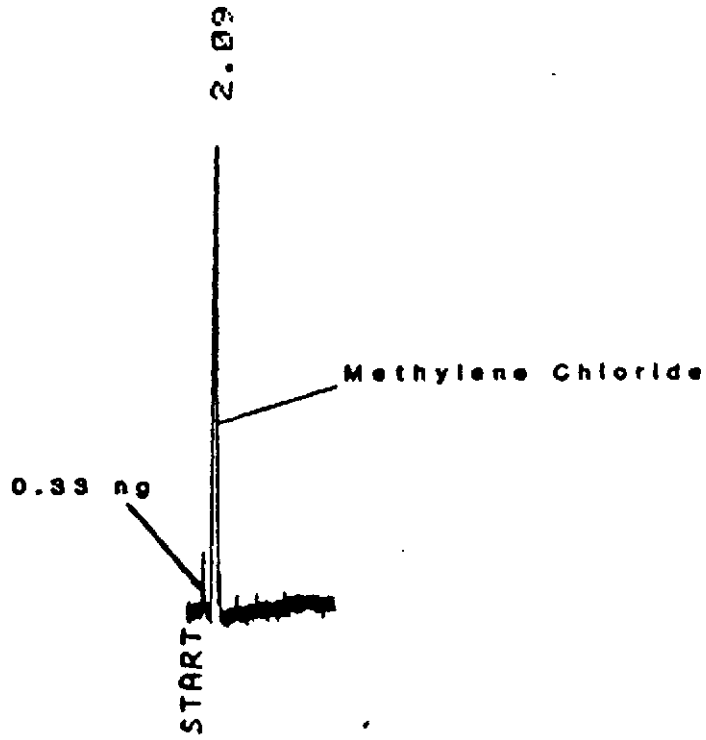

Figure 4.1. Chromatogram of the Analytical Detection Limit

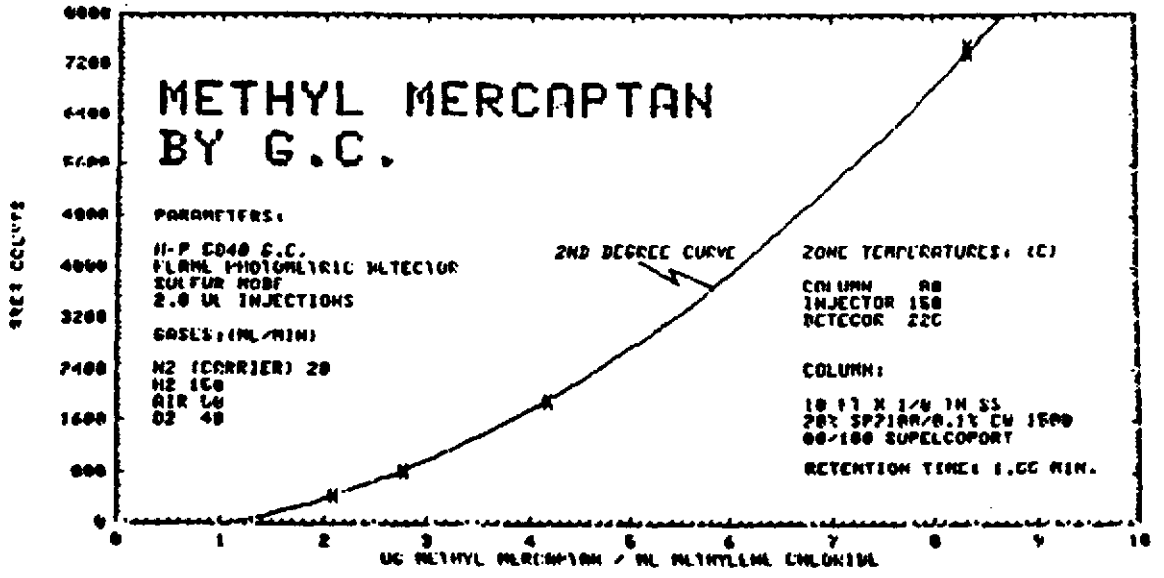

Figure 4.3.1. Calibration Curve

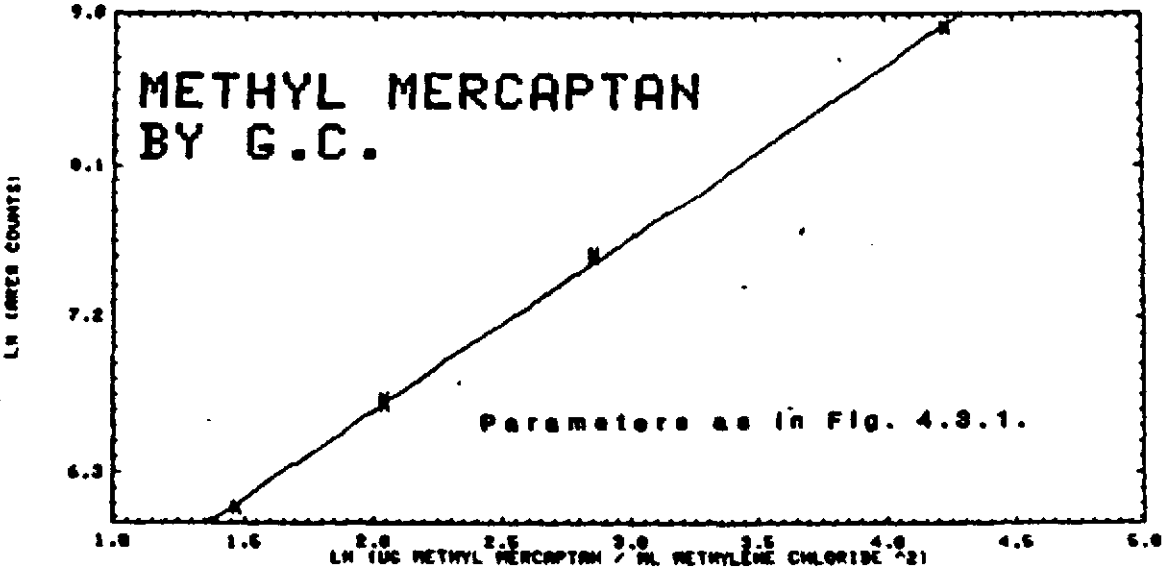

Figure 4.3.2. Calibration Curve

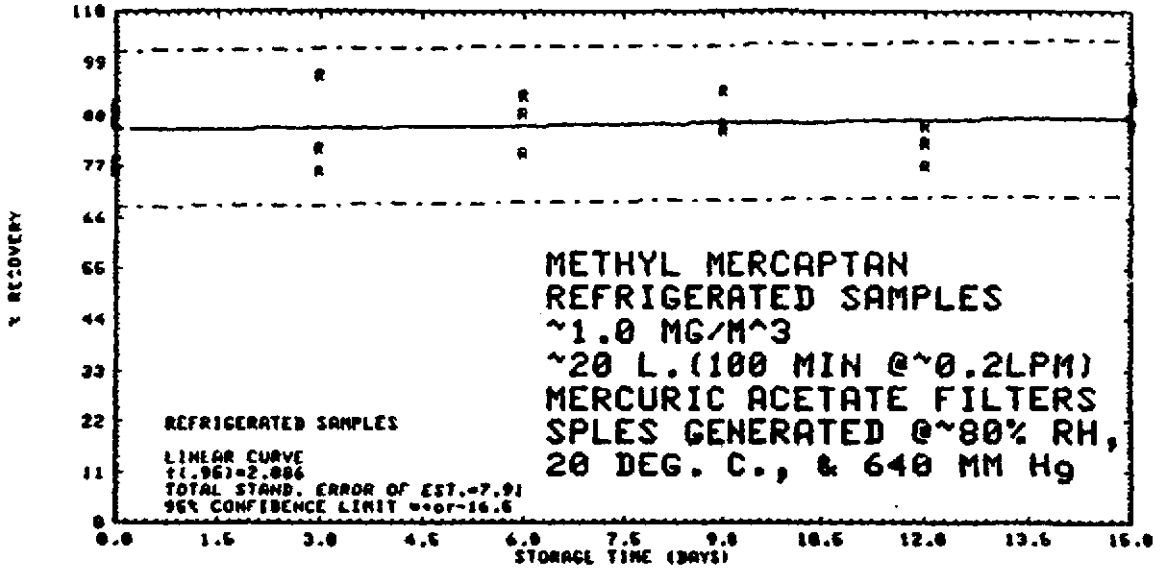

Figure 4.6.1. Refrigerated Storage

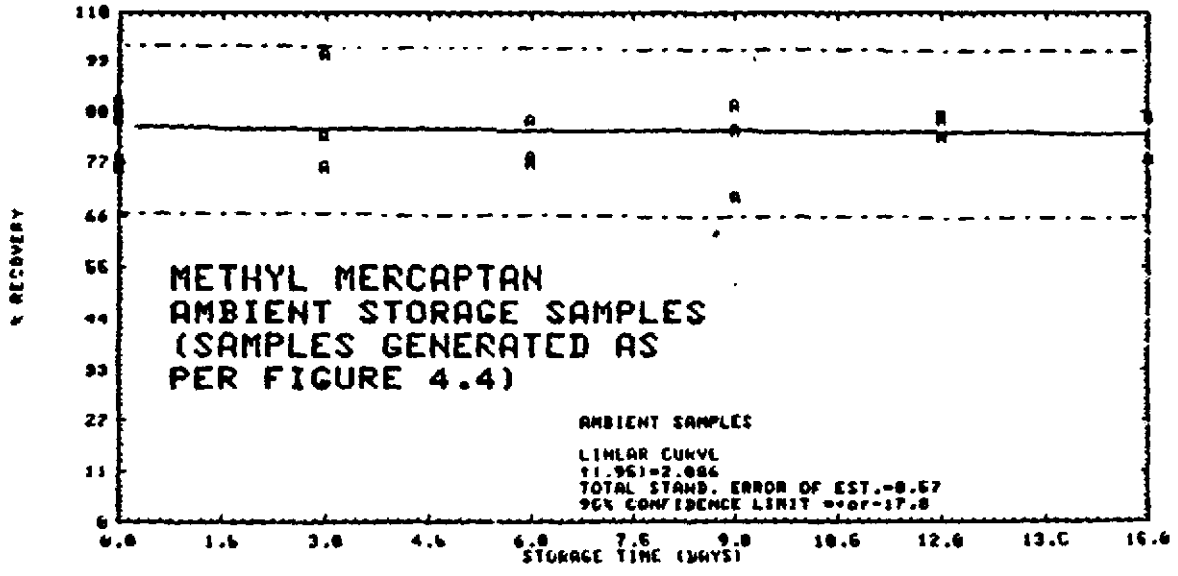

Figure 4.6.2. Ambient Storage

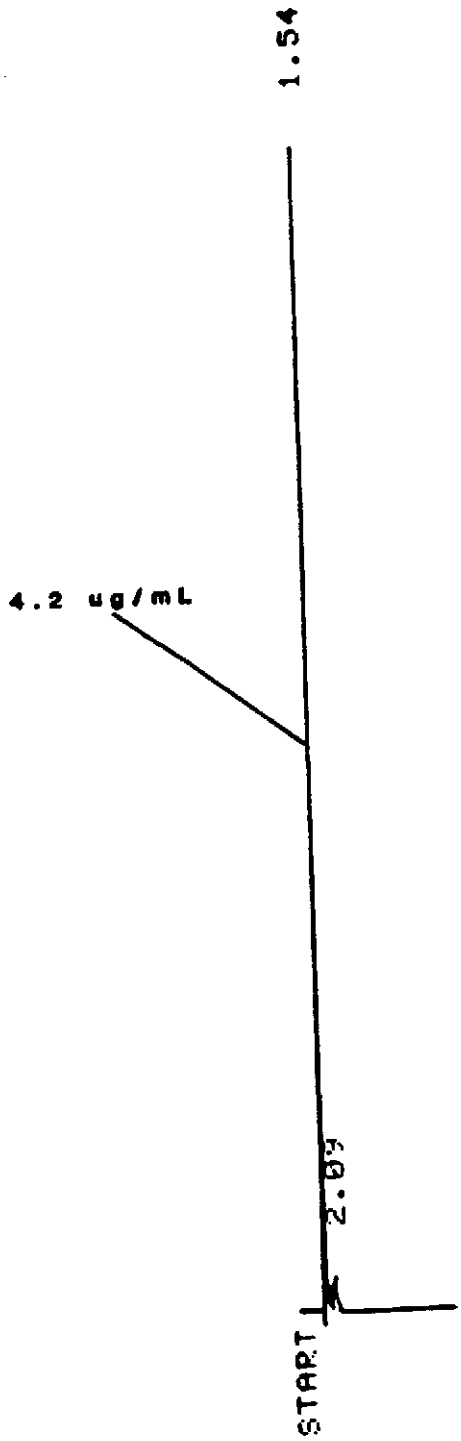

Figure 4.6. Chromatogram of a Standard

5. References

5.1. Moore, H., Helwig, R.J. Amer. Ind. Hyg. Assoc. J. 1960, 21, 466-70.

5.2. Nathans, M.W.; Jeong, A. In "Analytical Techniques in Occupational Health Chemistry", Dollberg, D.D.; Verstuyft, A.W., Eds.; American Chemical Society: Washington, D.C., 1980; p 231-9.

5.3. Okita, T. Atmos. Environ. 1970, 4, 93-102.

5.4. Knarr, R., Rappaport, S. Anal. Chem. 1980, 52, 733-6.

5.5. "Criteria for a Recommended Standard . . . Occupational Exposure to n-Alkane Monothiols, Cyclohexanethiol, and Benzenethiol", U.S. Dept. of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health: Cincinnati, OH 1978; p 116.

5.6. Technical information brochure for the HNU Model 52-02 Photoionization detector, HNU Systems, Inc., 30 Ossipee Road, Newton, MA 1978.

5.7. "Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment", American Conference of Governmental Industrial Hygienists: Cincinnati, OH, 1978; p 21.

5.8. Reference 5.5, p 3.

5.9. Shults, W.T., Fountain, E.N., Lynch E.C. J. Am. Med. Assoc. 1970, 211, 2153-4.

5.10. Reference 5.5, p 18.

5.11. Reference 5.5, p 20.

5.12. Reference 5.5, p 127 - 9.

5.13. "The Condensed Chemical Dictionary", Eighth Edition, Van Nostrand, Reinhold Company, New York, NY, 1971, p 577-8.

5.14. "The Merck Index," Eighth Edition, Stecher, P.G., Ed. Merck & Company, Inc., Rahway, N.J., 1968, p 671.

H2MGROUP

STANDARD OPERATING PROCEDURE FOR METHANE ANALYSIS

1.0 SUMMARY OF METHOD

The protocol is applicable for analysis of methane in air or gas with medium or high levels, e.g., landfill gases, stack gas, air above 0.20 mg/l.

The method involves direct sampling of the gas or air in leak tight containers without concentration. Analysis is performed by injection of aliquots onto a GC/FID. Other gases of C_2 to C_4 interfere with the analysis because the peaks do not separate on the analytical column. A total concentration of C_1 to C_4 constituents has to be reported if other gases are present.

Detection limit is 0.01 mg/l for 1 ml injection size.

2.0 SAMPLE COLLECTION

Sample vessels (preferably of glass) are flushed with clean inert gas to remove contaminants. They are sealed with stopcocks and additional plastic caps at the outlets and stored in a contamination free environment until sampling.

With a small hand pump, the sampling container is filled with the gas or air to be analyzed. The volume should be replaced several times to obtain a uniform concentration. Connections between pump and valve can be made with swagelock fittings and tygon bubble tubing.

3.0 HOLDING TIMES

Transport of the sample to the lab should occur rapidly and holding times should be minimized. If a sample cannot be analyzed within 24 hours after receipt, it is spiked with an internal standard of pentane. This permits monitoring of any losses due to leakage. (Use of the neat solvent is suitable for expected injection sizes of 10 to 250 ul for low samples. For larger injection sizes up to 1 ml, reduce pentane injection to 1 ul).

The sample should be stored refrigerated for no more than 14 days.

4.0 CALIBRATION

External Standard Method

A calibration curve has to be prepared daily with at least five (5) different amounts for the linear range, 30 ng to 3000 ng. For the higher calibration points from 300 to 3000 ng inject 10 to 100 ul of a 5% standard. Make a dilution of the standard gas 1:25 by injecting 10 ml of the gas into a 250 ml gas sampling valve and use that dilution for the lower range of the calibration curve. Use 10 ul to 250 ul gastight syringes with shutoff valves for injection.

A calibration check is performed by injecting a standard similar to the expected level of the samples. If the factor deviates by >20% or injections and checking of the standard indicate that the response has changed, corrective action has to be

taken. (Check the detector gases and check for leaks of the septum and syringes).

If no problem exists the system has to be re-calibrated.

5.0 INTERNAL STANDARD METHOD

Five different dilutions of the standard containing percent levels are prepared by injecting 10 ul to 10 ml of the gas into 250 ml sampling bulbs. Each sample is spiked with 3 ul of pentane. The relative areas for the analysis relative to the pentane are plotted against the concentrations. If the standard deviation of the relative factors is < 20% the response is linear and the average factor is used for computations.

Calibration checks are performed on a daily basis as in the external method.

6.0 ANALYSIS

Injections of the gas or air samples are made as in the calibration with gastight syringes directly into the injection port. The column used is a 10 ft. glass column, 1/4" OD, packed with 3% SP2100 on 100/120 mesh Supelcoport. Flowrate is 30 ml/min.

If only methane is expected in the samples, the GC is held at the lowest ambient temperature that can be maintained within ±1°C. At 31°C, the retention times are approximately 0.4 minutes for methane and 0.7 minutes for pentane.

If the samples contain higher molecular weight hydrocarbons or gasoline vapor the temperature is programmed to remove later eluding compounds before the next injection.

Quantification

Concentrations are calculated from the measured amounts and the injection sizes used. The results of duplicate Injections are averaged and data reported as mg/l or % for very high samples.

7.0 QA/QC REQUIREMENTS

7.1 Method Validation

Multiple injections of a known standard give the following results for accuracy and precision.

ACCURACY: Average recovery was 83% ranging from 65% to 115%.

PRECISION: RSD = 20.3% (relative standard deviation)

7.2 Continuous Quality Control

Blanks

Carryover has been documented for high level samples if the sample syringe is used subsequently. Trapped gas can easily be removed by repeated injections of air from a hot surface like an oven or hotplate through the syringe. Solvent cleaning has to be avoided because residues cause interferences on the FID.

Trip blanks which accompany sample bags to and from the field will be prepared by filling a clean air bag with purified air. Field blank will be filled with ambient air in the field.

To check for complete removal of methane a blank volume of ambient air is injected after high sample.

7.3 Reproductivity

Positive samples are injected in duplicate. If the RPD (relative percent difference) of the results exceed 20%, the sample is injected again. Results are averaged.

7.4 Accuracy

The limit for accuracy is defined as 2.44 x RSD which is 61%. A gas of a known concentration is injected for every group of 20 samples or at least daily when analyses are performed.

STANDARD OPERATING PROCEDURE FOR DETERMINATION OF VOLATILE ORGANICS IN AIR (Modified Method T01-T02)

1.0 - SCOPE AND APPLICATION

The method was designed to analyze for low levels of volatile organics. It has been applied for the compounds targeted in the Purge and Trap Method 624 and the additional compounds listed in the Targeted Compound List (TCL) of the Contract Lab Protocol (CLP). The application could be expanded to comprise petroleum hydrocarbon paraffins with a chain length larger than propane. (Methane and ethane are not analyzable with this method).

This procedure is applicable for the determination of the volatile organics in raw landfill gas, process gas as well as ambient air. It is designed to meet the monitoring requirements of gas producing industries, the Gas Research Institute and state and federal regulatory agencies.

Depending on the levels encountered, various collection methods would be applicable. Sorbent tube collection with heat desorption covers the broadest range of concentrations. This is the only method capable of detecting a concentration of one part per billion or slightly lower. If high levels are to be analyzed or unknown samples have to be prescreened for the concentration level, the volume collected can be scaled down appropriately, not to overload the analytical system. Doing this would however at the same time sacrifice sensitivity.

2.0 - SUMMARY OF METHOD

This procedure is based on the EPA Methods TO1 and TO2 of the "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air". We have further developed this method, incorporating information obtained from environmental and our in-house experience of analyzing landfill samples for five (5) years. The drawback of Methods TO1 and TO2 is that two independent samples have to be obtained and one analyzed for highly volatile and the other for heavier molecular weight volatile organics. Our method combines both scans into one analysis by introduction of several layers of packing material into the sorbent tubes, (similar to the traps employed for Methods 601, 602 and 624).

In addition to carbon and tenax, ambersorb, a spherical carbon is also used as an absorbent for medium molecular weight compounds which are difficult to desorb off of carbon.

Analysis can be performed by packed or capillary column. Analytically, the way the sample is collected and introduced into the instrument does not matter. The analytical procedures are actually identical for the same compounds in water or soil. Any of the stipulations concerning instrumentation, tuning, calibrating and reporting would be the same as specified in EPA Method 624 or the CLP for purgeable organics. Development of acceptance limits for the quality control aspects for blanks, precision and accuracy, tuning and calibration also follow the same principals. Light, medium and heavy compounds are efficiently trapped and desorbed. The composition of the sorbent tubes follows recommendations by Envirochem. Efficiency of trapping and desorption were verified during method development.

A known volume of air or gas is passed through the sorbent tube to collect the contaminants. In the laboratory they are desorbed by heating and back flushing to the GC/MS.

3.0 - COMMENTS

[SEE PROCEDURE SECTION]

4.0 - SAFETY ISSUES (OR PREPARING)

Whenever handling standards and hazardous substances always consult your laboratory's Health and Safety Plan.

5.0 - SAMPLE COLLECTION, PRESERVATION CONTAINERS AND HOLDING TIMES

5.1 - Materials and Equipment

- Field sampling unit, capable of maintaining consistent flow rate needed to collect desired flow volume over a reasonable collection time. The unit is to consist of portable pump, power supply, fine metering valve, dual range flow meter.
- Sample trap - 1/4-inch O.D. by 8-inch glass tubes packed with glass beads, Tenax-TA, Ambersorb XE-340 and activated charcoal.
- Storage container with carbon bed for traps.
- Trap holders.
- Container that can be environmentally controlled, if temperature rises above 4° C.

- Miscellaneous tools and swagelok fittings.
- Connector for sorbent tube to sampling site (port).
- Field data forms.

5.2 - Sampling Procedure

For inlet gas, ambient air and surface gas a sampling train including a pump and flow meter is needed.

5.3 - Flow Adjustment

The pressure on the sampling ports vary and the settings on the valves have to be adjusted for each sample port to achieve the desired flow rate. A dummy tube of equal backpressure is used for this purpose prior to sampling. Typical flow rates are calibrated to between 45 to 50 cc per minute.

5.4 - Sample Collection

After the correct flow rate has been established, the sample tube is connected and the gas (or air) passed through the sorbent for the duration necessary to collect the desired flow volume. The flow has to be monitored on the flow meter during sampling and maintained throughout the sampling time.

5.5 - Data Logging

All data pertaining to the sampling site and the parameters for the individual sample have to be recorded on field data forms.

The sorbent tubes are clearly labelled with numbers, which have to be referenced in the records on the data forms.

5.6 - Preservation and Handling

All traps and sampling devices should be subject to similar handling and storage conditions. A chain-of-custody from sample trap preparation through analysis and recycling must be established and strictly enforced.

Storage and sorbent traps should be in a contamination free area.

At temperatures exceeding 4° C during sampling and shipping, the sample containers should be stored in a cooler.

Samples must be analyzed within a fourteen (14) day holding period from the date that sampling was performed.

6.0 - APPARATUS

[SEE PROCEDURE SECTION]

7.0 - REAGENTS AND STANDARDS

[SEE PROCEDURE SECTION]

8.0 - PROCEDURE

The analysis for volatile compounds by GC/MS can be performed on either packed column or capillary column. The packed column method follows the protocol of EPA Method 624. Capillary column analysis offers better separation of analytes. It is accepted as an alternative in the CLP for analysis of organic volatiles.

H2M employs both packed as well as capillary analysis. For capillary column the compounds have to undergo an extra concentration step to introduce them in a narrow band onto the column. Two techniques are employed: Minitrap on an Envirochem Concentrator or Cryofocusing with a Tekmar Interface.

8.1 - Sample Preparation

The primary difference between water and air analysis is that for volatiles in water, the compounds have to first be brought into the vapor phase by "purging" before they can be collected on the trap. In the case of the volatiles in air, they are already concentrated on the sorbent tube, ("trap") ready to be desorbed for analysis.

The compounds are released from the packing by heating the tubes to 220° C. The compounds are back flushed with the carrier gas to the head of the analytical column. For packed column analysis all that is needed is a desorber in line with the GC/MS that is capable of rapidly heating the tubes to the desired temperature and holding it for the time needed for desorption.

For capillary analysis the compounds released from the tubes have to be "focused" before they are introduced onto the column inlet. This "band narrowing" is accomplished either on an Envirochem Concentrator by concentrating the compounds after the sorbent tube on a minitrap before they are transferred to the GC

or in a Cryogenic Interface by Tekmar, where the volatiles are "focused" by cooling with liquid nitrogen.

8.2 - Calibration and Tuning

Tuning and calibration procedures and acceptance criteria are the same as those specified in EPA Method 624 or the CLP for purgeable organics.

8.3 - Analysis

The protocols for purgeable analysis specify internal standard method. introduction of the internal standard spike is performed differently depending on what system is used. The Envirochem Concentrator provides a special injection port that permits injection of a gas spike onto the head of the sorbent tube. For packed column analysis, the surrogate standard can be injected into the packed column injection port. This injection has to be synchronized with the start of the desorption step. For the system with cryofocusing a special valve has been added into the system configuration for injection of the internal standard.

Techniques followed for calibration and tuning of the GC/MS are the same as in water analysis. The same is true for the process of identification and qualification.

Data can be reported as $\mu g/m^3$. If ppb (by volume) units are required for the results, the concentrations are converted according to the formula:

$$1 \text{ ppb (vol.)} = \frac{MW}{24.5} \mu g/m^3$$

Where MW is the molecular weight of the compound in gram and 24.5 is the volume of one mole of an inert gas at ca.25° C.

9.0 - QA/QC REQUIREMENTS

9.1 - QC Samples

- QC Samples

It is advisable to collect all sorbent tubes in duplicate so that a spare sample is available in the event of an instrument malfunction and to assess the precision of the technique.

Traps packed in the laboratory must be checked for uniformity of packing by checking the backpressure. Tubes purchased from Envirochem are subject to their QC procedure.

All traps have to be conditioned in a contamination free area for 10 minutes at 250° C with a slow flow of nitrogen. After cool down (under gas flow), the tubes are immediately sealed in screw top tube holders, sealed and stored in capped wide mouth jars over a bed of carbon. The carbon has to be replaced for each batch.

Holding times until analysis cannot exceed fourteen (14) days.

- Mounting Blank

A sorbent tube is analyzed to verify that the instrument is free from contaminants.

- Conditioning Blank

One trap of each batch has to be analyzed for contamination before the batch is released for collection of samples.

- Duplicates

Parallel samples can be taken at the same source for reproducibility studies. This can be achieved in one of two ways. The first involves simultaneous sampling by attaching two traps to a splitter. The volumes (and therefore, the concentration measured) will vary slightly based on different backpressures of the traps. The other method where samples are sequentially collected might not be representative, if the concentration of the sample cannot be assumed to be constant. These factors are taken into account when evaluating precision data.

- Backup Tubes for Breakthrough Studies

Recovery studies in the laboratory have been limited to flow volumes of one liter with concentrations ranging from low ppb to low ppm levels. At this volume, no breakthrough could be detected. The expected breakthrough volume are expected to resemble those of the NIOSH carbon tubes listed in the NIOSH sampling procedures.

If large volumes are to be collected, backup tubes should be collected in tandem, to check for breakthrough. In particular in very wet conditions the capacity of the collection tubes is decreased due to the moisture retained on the carbon. It then is advisable to check for breakthrough for any volumes exceeding one liter.

- Trip Blank

Each batch of tubes for sample collection is accompanied by two blank tubes that are sealed and stored in the same manner as the sample tubes. They are shipped back to the laboratory

together with the exposed sample tubes for analysis. Analytes found on these traps indicate contamination during shipping and storage and render positives of the same analytes on the sample tubes questionable.

- Field Blank

A sorbent tube can be taken out in the field and either opened for the same amount of time as the sample sorbent tube or ambient passed through the tube to determine any contamination that may be picked up from the sampling site.

9.2 - Acceptance Criteria

When analyzing for TCL compounds by this method, CLP acceptance criteria is used. (See CLP SOW 2/88 for Organic Analyses).

9.3 - Corrective Action Required

Correction action required will be performed as outlined in QAPjP.

10.0 - CALCULATIONS

[SEE PROCEDURE SECTION]

11.0 - REPORTING

[SEE TABLES 1 AND 2]

12.0 - REFERENCES

1. "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air", U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, 1988.

TABLE 1

METHOD DETECTION AND QUANTIFICATION LIMITS

FOR VOLATILE ORGANICS IN AIR

VOLATILES	CAS NUMBER	INSTRUMENT DETECTION LIMIT ppb (vol.) FOR 1 LITER	QUANTIFICATION LIMIT ppb (vol.) FOR 1 LITER
Chloromethane	74-87-3	2	10
Bromomethane	74-83-9	2	10
Vinyl Chloride	75-01-4	2	10
Chloroethane	75-00-3	2	10
Methylene Chloride	75-09-2	1	5
Acetone	67-64-1	2	10
Carbon Disulfide	75-15-0	1	5
1,1-Dichloroethane	75-35-4	1	5
1,1-Dichloroethane	75-35-3	1	5
trans-1,2-Dichloroethene	156-60-5	1	5
Chloroform	67-66-3	1	5
1,2-Dichloroethane	107-06-2	1	5
2-Butanone	78-93-3	1	5
1,1,1-Trichloroethane	71-55-6	1	5
Carbon Tetrachloride	56-23-5	1	5
Vinyl Acetate	108-05-4	1	5
Bromodichloromethane	75-27-4	1	5
1,1,2,2-Tetrachloroethane	79-34-5	1	5
1,2-Dichloropropane	78-87-5	1	5
trans-1,3-Dichloropropene	10061-02-6	1	5
Trichloroethene	79-01-6	1	5
Dibromochloromethane	124-48-1	1	5
1,1,2-Trichloroethane	79-00-5	1	5
Benzene	71-43-2	1	5
cis-1,3-Dichloropropene	10061-01-5	1	5
2-Chloroethyl Vinyl Ether	110-75-8	1	5
Bromoform	75-25-2	1	5
2-Hexanone	591-78-6	1	5
4-Methyl-2-pentanone	108-10-1	1	5
Tetrachloroethene	127-18-4	1	5
Toluene	108-88-3	1	5
Chlorobenzene	108-90-7	1	5
Ethyl Benzene	100-41-4	1	5
Styrene	100-42-5	1	5
Total Xylenes			

PRECISION AND ACCURACY

LIMITS FOR METHOD 602

Compound	Precision as RPD	Accuracy
Benzene	40	60-140
Toluene	40	60-140
m-Xylene	40	60-140
p-Xylene	40	60-140
o-Xylene	40	60-140
Ethylbenzene	40	60-140
Chlorobenzene	40	60-140
1,2-Dichlorobenzene	40	60-140
1,3-Dichlorobenzene	40	60-140
1,4-Dichlorobenzene	40	60-140

Times for Method, Sample Containers, Perservation, and Holding Times for Hide Pile Gas Analysis

Parameters	Reference	Container	Preservation	Holding Time
Volatile Organics	TO-1 and TO-2	Glass tube filled with charcoal, ambersorb glass beads and tenax	Stored in sealed containers with carbon @ 4°C	14 days
Methyl Mercaptan	OSHA 26	Hg filter	4°C	14 days
Hydrogen Sulfide	NIOSH PGCAM 126	Impinger	4°C	30 hrs.
Methane	GC/FID	Gas Sampling Bag	4°C	30 hrs.

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APPENDIX B

SURFACE EMISSIONS MEASUREMENT
DATA FORMS/CHAIN OF CUSTODY SHEETS

H2M LABS, INC.

Environmental and Industrial Analytical Laboratory

575 Broad Hollow Road, Melville, N.Y. 11747-5076
(516) 694-3040
FAX: 516-694-4122

PROJ. NO. IPSR 8901

PROJECT NAME: Industriplex Gas Treatability Study

SAMPLERS: (Signature) Caroline Polanisk

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	TOTAL NO. OF CONTAINERS	Volatile organics	Methyl mercaptan	Hydrogen sulfide	Methane	REMARKS
HP3	5/18/90	2:55		X	IP0A2HP3000316	4	/	/	/	/	
HP1	5/18/90	5:42		X	IP0A2HP1000316	4	/	/	/	/	
FB1	5/19/90	8:44		X	IP0A2FB1000318	4	/	/	/	/	Field Blank
HP2	5/19/90	10:10		X	IP0A2HP2000317	4	/	/	/	/	
HP2	5/19/90	11:42		X	IP0A2HA2000318	4	/	/	/	/	Duplicate
HP7	5/19/90	1:15		X	IP0A2HP7000318	4	/	/	/	/	
HP9	5/19/90	3:29		X	IP0A2HP9000316	4	/	/	/	/	
HP4	5/19/90	5:12		X	IP0A2HP4000316	4	/	/	/	/	
TB1	5/18/90	—		X	IP0A2TB1000316	2	/		/		Trip Blank

Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Ken Whitty	5/17/90	0900	Caroline Polanisk				
Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Relinquished by: (Signature)	Date	time	Received for Laboratory by: (Signature)	Date	time	Remarks	
Caroline Polanisk			Ken Whitty	5/21/90	0930		

H2M LABS, INC.

Environmental and Industrial Analytical Laboratory

575 Broad Hollow Road, Melville, N.Y. 11747-5076
(516) 694-3040
FAX: 516-694-4122

PROJ. NO. TPSR 9201

PROJECT NAME INDUSTRIPLEX - GAS TREATABILITY STUDY

SAMPLERS: (Signature) Patricia Planish

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	TOTAL NO. OF CONTAINERS	Volatile organics	Methanol MS/MSD from sediment	Methane	REMARKS
SA-3	8/21/90	9:05		X	IP OA2 FB2000320 2	4	1	1	1	
HP-1	8/21/90	11:45		X	IPCA2 HP100032 02	4	1	1	1	
HP-2	8/21/90	14:15		X	IPCA2HP2 000320 2	11	3	3	2	FOR MS/MSD

Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Richard Sieg	8/20/90	12:00	Patricia Planish				
Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Relinquished by: (Signature)	Date	time	Received for Laboratory by: (Signature)	Date	time	Remarks	
Patricia Planish	8/22/90	9:00	Richard Sieg				

H2M LABS, INC.

Environmental and Industrial Analytical Laboratory
575 Broad Hollow Road, Melville, N.Y. 11747-5076
(516) 694-3040
FAX: 516-694-4122

PROJ. NO.	PROJECT NAME
IPSR #701	INDUSTRI-PLEX · GASTREATABILITY STUDY

SAMPLERS: (Signature) Christine Petrucci

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	TOTAL NO. OF CONTAINERS	Volatile Organics	Acid Extractables	Base/Neutrals	PCB's/Pesticides						REMARKS
BD	8/2/90	8:59		X	IPOA2B100003202	9	2	2	3	2						Duplicate

Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Rahul Tilg	8/2/90	12:00	Christine Petrucci				
Relinquished by: (Signature)	Date	time	Received by: (Signature)	Relinquished by: (Signature)	Date	time	Received by: (Signature)
Relinquished by: (Signature)	Date	time	Received for Laboratory by: (Signature)	Date	time	Remarks	
Christine Petrucci	8/2/90	4:00	Rahul Tilg				

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SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/18/90 SAMPLERS CP/CES/CJF

LOCATION HP-3

SURFACE DESCRIPTION Continuous fill - non vegetated

INSTRUMENT TYPE Foxboro Model # OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
2:18 pm	5.0	1	—	—	—	—	2.8	Heavy Rain
2:24	5.0	2	11.4	12.7	9.3	8.5	3.8	"
2:30	5.0	3	9.8	13.3	8.9	8.0	1.2	Clearing
2:36	5.0	4	8.5	13.2	8.5	9.1	0.6	"
2:40	5.0	5	8.5	13.2	8.0	9.4	0.3	"
2:46	5.0	6	8.2	12.6	8.3	10.2	0.2	"
2:50	5.0	7	6.9	13.5	10.8	15.3	—	began sampling
4:18	5.0	8	7.2	8.2	10.0	11.3	—	
4:55	5.0	9	11.2	11.7	9.8	11.7	—	
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/18/90 SAMPLERS CP/CES/CJF

LOCATION HP-1

SURFACE DESCRIPTION Grass cover

INSTRUMENT TYPE Foxboro Model #OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
5:09 PM	5.0	1	16.5	12.5	9.7	11.3	0.2	rain
5:15	5.0	2	19.3	13.3	8.7	11.0	2.0	rain
5:21	5.0	3	18.8	13.6	7.8	10.3	1.0	clearing
5:27	5.0	4	18.7	12.8	8.8	10.7	0.8	11
5:33	5.0	5	20.7	14.0	10.0	13.3	0.2	11
5:39	5.0	6	20.2	13.6	10.4	13.5	1.5	11
6:03	5.0	7	20.4	13.4	9.2	12.0	—	began discrete sampling
6:25	5.0	8	20.8	11.1	11.0	11.2	—	
7:00	5.0	9	10.7	13.9	11.2	8.1		
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/19/90 SAMPLERS CP/CES/CJF

LOCATION Field Blank / Back of Truck

SURFACE DESCRIPTION Teflon Sheet

INSTRUMENT TYPE OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
8:16	5.0	1	9.8	9.8	9.8	9.8	6.0	
8:22	5.0	2	10.4	11.4	—	—	5.3	
8:28	5.0	3	10.6	11.4	—	—	5.0	
8:34	5.0	4	10.6	11.2	—	—	5.0	
8:40	5.0	5	10.8	10.9	—	—	4.8	
9:21	5.0	6	10.5	11.7	—	—		began sampling
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/19/90 SAMPLERS CP/CES/CJF

LOCATION HP-2

SURFACE DESCRIPTION Sloped - non vegetated

INSTRUMENT TYPE Foxboro Model # OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
		1						
9:44	5.0		17.4	18.3	18.3	20.0	880	
		2						
9:50	5.0		22.4	24.7	22.7	26.7	960	
		3						
9:56	5.0		16.6	21.8	16.8	21.2	1000	
		4						
10:02	5.0		17.3	22.5	17.2	22.5	1000	
		5						
10:08	6.0		22.8	26.7	25.4	21.9	1000	began sampling
		6						
10:40	5.0		21.6	20.4	20.5	18.9	—	
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/19/90 SAMPLERS CP/CES/CJF

LOCATION HP2 - Duplicate

SURFACE DESCRIPTION Sloped - corrugated

INSTRUMENT TYPE Foxboro Model #OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
		1						
11:32	5.0		12.3	20.7	13.0	19.0	1000	
		2						
11:28	5.0		11.4	20.0	11.4	16.8	1000	
		3						
11:34	5.0		11.6	20.1	12.4	17.3	1000	
		4						
11:40	5.0		11.8	20.3	12.0	17.0		began sampling
		5						
12:03	5.0		11.0	17.4	9.8	14.7	—	
		6						
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/19/90 SAMPLERS CES/CP/CJF

LOCATION HP-7

SURFACE DESCRIPTION Flat area by Top of Pile

INSTRUMENT TYPE Foxboro Model #OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
PM 12:46	5.0	1	14.3	17.5	14.5	16.0	6	
12:52	5.0	2	14.2	19.2	14.5	16.1	8.2	
12:58	5.0	3	14.9	18.2	15.0	16.5	11.0	
12:04	5.0	4	14.7	18.1	15.1	17.0	8.0	
12:10	5.0	5	15.0	18.2	15.2	17.1	9.0	began Sampling
1:42	5.0	6	14.2	17.7	15.0	16.8	—	Sampling
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/19/90 SAMPLERS CP/CJF/CES

LOCATION HP-9

SURFACE DESCRIPTION GRASS

INSTRUMENT TYPE Foxboro Model #OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
PM 3:14	5.0	1	13.1	24.6	10.4	19.7	62	
3:20	5.0	2	14.4	24.6	12.5	19.5	63	
3:26	5.0	3	14.6	23.1	12.1	18.5	56	
3:32	5.0	4	13.5	21.0	11.8	15.8	60	
4:20	5.0	5	11.3	17.4	11.2	14.4		Began Sampling
		6						
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 5/19/90 SAMPLERS CP/CES/CJF

LOCATION HP-4

SURFACE DESCRIPTION Summit, FLAT WITH GRASS

INSTRUMENT TYPE Foxboro Model # OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
		1						
16:42	5.0		15.8	19.1	16.0	19.1	4	
		2						
16:48	5.0		14.9	19.2	15.1	19.3	3.8	
		3						
16:54	5.0		14.5	19.3	14.5	19.2	3.6	
		4						
17:00	5.0		13.6	18.0	13.5	17.6	3.2	began sampling ✓
		5						
17:23	5.0		13.5	16.3	13.2	16.3	—	—
		6						
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 8/21/90 SAMPLERS CP/CES/CJF

LOCATION Field Blank/Back of Truck

SURFACE DESCRIPTION Teflon Sheet

INSTRUMENT TYPE OVA-128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
8:25	5.0	1	14	18	14	17	0	
8:31	5.0	2	13	18	13	17	0	
8:37	5.0	3	13	18	13	17	0	
8:43	5.0	4	13	17	12	17	0	
8:49	5.0	5	13	19	13	17	0	
11:02	5.0	6	14	23	14	23	0	END sample collection
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 8/21/90 SAMPLERS CP/CES/CJF

LOCATION HP-7

SURFACE DESCRIPTION Flat

INSTRUMENT TYPE OVA 128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
		1						
11:18	5.0		16	20	18	18	4.7	
		2						
11:24	5.0		17	22	18	19	4.5	
		3						
11:30	5.0		16	22	17	18	4.3	
		4						
11:36	5.0		16	22	16	18	4.3	
		5						
12:44	5.0		20	30	21	24	—	END Sample Collection
		6						
		7						
		8						
		9						
		10						

H2MGROUP

SURFACE EMISSION MEASUREMENT DATA FORM

DATE 8/21/90 SAMPLERS CP/CES/CJF

LOCATION HP-2 MS/MSD

SURFACE DESCRIPTION Sloped

INSTRUMENT TYPE OVA 128

Time	Sweep Air (l/min)	Resid. Time	Air Temp °C Cham.	Air Temp °C Amb.	Soil Temp °C Cham.	Soil Temp °C Amb.	Real Time OVA (ppm)	Comments
2:08	5.0	1	21	22	19	22		
2:14	5.0	2	22	22	22	24		
2:20	5.0	3	22	23	21	27		
2:26	5.0	4	24	22	22	27		
2:32	5.0	5	23	24	20	27		
7:09	5.0	6	13	18	10	10		END SAMPLE COLLECTION
		7						
		8						
		9						
		10						

H2MGROUP

APPENDIX C

LABORATORY RESULTS FOR DISCRETE SAMPLING

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759049
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2HP1000312 Tube 8109
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
Acetone		125
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Date Analyzed: 5/22/90
Date Reported: 6/01/90

Quantification limit: 24 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 49 ug/m3

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759050
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IP9R-8901
IP0A2HP2000312 Tube 687
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
Trichlorofluoromethane		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND]
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
2-Chloroethylvinyl Ether	1)	ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
1,2-Dichlorobenzene		ND
1,3-Dichlorobenzene		ND
1,4-Dichlorobenzene		ND
Acetone		57
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 22 ug/m3

ND - Under Quantification Limit

1) Quantification limit: .44 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759052
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2HP3000312 Tube B113
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
Trichlorofluoromethane		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND]
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		35
2-Chloroethylvinyl Ether	1)	ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
1.2-Dichlorobenzene		ND
1,3-Dichlorobenzene		ND
1,4-Dichlorobenzene		ND
Acetone		ND
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 21 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 42 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759053
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2HF4000312 Tube 8148
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
Trichlorofluoromethane		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND]
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
2-Chloroethylvinyl Ether	1)	ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
1,2-Dichlorobenzene		ND
1,3-Dichlorobenzene		ND
1,4-Dichlorobenzene		ND
Acetone		ND
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 19 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 37 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759054
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2HF7000312 Tube 885
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
Trichlorofluoromethane		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND]
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
2-Chloroethylvinyl Ether	1)	ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
1,2-Dichlorobenzene		ND
1,3-Dichlorobenzene		ND
1,4-Dichlorobenzene		ND
Acetone		73
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 19 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 37 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 1174
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759055
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2HP9000312 Tube 5116
Collected By: CF 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
Trichlorofluoromethane		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND]
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
2-Chloroethylvinyl Ether	1)	ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
1,2-Dichlorobenzene		ND
1,3-Dichlorobenzene		ND
1,4-Dichlorobenzene		ND
Acetone		ND
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 18 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 37 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006532

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B128

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP70003202
REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<43		
BROMOMETHANE	<43		
VINYL CHLORIDE	<43		
CHLOROETHANE	<43		
METHYLENE CHLORIDE	<22		
TRICHLOROFLUOROMETHANE	<22		
1,1-DICHLOROETHENE	<22		
1,1-DICHLOROETHANE	<22		
C/T-1/2-DICHLOROETHENE	<22		
CHLOROFORM	<22		
1,2-DICHLOROETHANE	<22		
1,1,1-TRICHLOROETHANE	<22		
CARBON TETRACHLORIDE	<22		
BROMODICHLOROMETHANE	<22		
1,2-DICHLOROPROPANE	<22		
TRANS-1,3-DICHLOROPROPENE	<22		
TRICHLOROETHENE	<22		
DIBROMOCHLOROMETHANE	<22		
1,1,2-TRICHLOROETHANE	<22		
CIS-1,3-DICHLOROPROPENE	<22		
BENZENE	<22		
2-CHLOROETHYLVINYL ETHER	<43		
BROMOFORM	<22		
1,1,2,2-TETRACHLOROETHANE	<22		
TETRACHLOROETHENE	<22		
TOLUENE	<22		
CHLOROBENZENE	<22		
ETHYLBENZENE	<22		
1,2-DICHLOROBENZENE	<22		
1,3-DICHLOROBENZENE	<22		
1,4-DICHLOROBENZENE	<22		

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DATE ISSUED 09/10/90

DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

Stanley Freedman
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006533

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B141

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP20003202

REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<46		
BROMOMETHANE	<46		
VINYL CHLORIDE	<46		
CHLOROETHANE	<46		
METHYLENE CHLORIDE	<23		
TRICHLOROFLUOROMETHANE	<23		
1,1-DICHLOROETHENE	<23		
1,1-DICHLOROETHANE	<23		
C/T-1/2-DICHLOROETHENE	<23		
CHLOROFORM	<23		
1,2-DICHLOROETHANE	<23		
1,1,1-TRICHLOROETHANE	<23		
CARBON TETRACHLORIDE	<23		
BROMODICHLOROMETHANE	<23		
1,2-DICHLOROPROPANE	<23		
TRANS-1,3-DICHLOROPROPENE	<23		
TRICHLOROETHENE	<23		
DIBROMOCHLOROMETHANE	<23		
1,1,2-TRICHLOROETHANE	<23		
CIS-1,3-DICHLOROPROPENE	<23		
BENZENE	<23		
2-CHLOROETHYLVINYL ETHER	<46		
BROMOFORM	<23		
1,1,2,2-TETRACHLOROETHANE	<23		
TETRACHLOROETHENE	<23		
TOLUENE	<23		
CHLOROBENZENE	<23		
ETHYLBENZENE	<23		
1,2-DICHLOROBENZENE	<23		
1,3-DICHLOROBENZENE	<23		
1,4-DICHLOROBENZENE	<23		

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DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

Stanley Isaacson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006536

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B137

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003202
REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<42		
BROMOMETHANE	<42		
VINYL CHLORIDE	<42		
CHLOROETHANE	<42		
METHYLENE CHLORIDE	<21		
TRICHLOROFLUOROMETHANE	<21		
1,1-DICHLOROETHENE	<21		
1,1-DICHLOROETHANE	<21		
C/T-1/2-DICHLOROETHENE	<21		
CHLOROFORM	<21		
1,2-DICHLOROETHANE	<21		
1,1,1-TRICHLOROETHANE	<21		
CARBON TETRACHLORIDE	<21		
BROMODICHLOROMETHANE	<21		
1,2-DICHLOROPROPANE	<21		
TRANS-1,3-DICHLOROPROPENE	<21		
TRICHLOROETHENE	<21		
DIBROMOCHLOROMETHANE	<21		
1,1,2-TRICHLOROETHANE	<21		
CIS-1,3-DICHLOROPROPENE	<21		
BENZENE	12000		
2-CHLOROETHYLVINYL ETHER	<42		
BROMOFORM	<21		
1,1,2,2-TETRACHLOROETHANE	<21		
TETRACHLOROETHENE	<21		
TOLUENE	12000		
CHLOROBENZENE	200		
ETHYLBENZENE	130		
1,2-DICHLOROBENZENE	<21		
/ 1,4-DICHLOROBENZENE	500		
\ 1,3-DICHLOROBENZENE	-		

/ REPORTED VALUE
\ REPRESENTS TOTAL

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DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

DATE ISSUED 09/14/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759051
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2HP2000312 Dup. Tube 8124
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
Acetone		ND
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 25 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 50 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006537

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B164

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B10003202-DUP
REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<52		
BROMOMETHANE	<52		
VINYL CHLORIDE	<52		
CHLOROETHANE	<52		
METHYLENE CHLORIDE	<26		
TRICHLOROFLUOROMETHANE	<26		
1,1-DICHLOROETHENE	<26		
1,1-DICHLOROETHANE	<26		
C/T-1/2-DICHLOROETHENE	<26		
CHLOROFORM	<26		
1,2-DICHLOROETHANE	<26		
1,1,1-TRICHLOROETHANE	<26		
CARBON TETRACHLORIDE	<26		
BROMODICHLOROMETHANE	<26		
1,2-DICHLOROPROPANE	<26		
TRANS-1,3-DICHLOROPROPENE	<26		
TRICHLOROETHENE	<26		
DIBROMOCHLOROMETHANE	<26		
1,1,2-TRICHLOROETHANE	<26		
CIS-1,3-DICHLOROPROPENE	<26		
BENZENE	14000		
2-CHLOROETHYLVINYL ETHER	<52		
BROMOFORM	<26		
1,1,2,2-TETRACHLOROETHANE	<26		
TETRACHLOROETHENE	<26		
TOLUENE	12000		
CHLOROBENZENE	<26		
ETHYLBENZENE	<26		
1,2-DICHLOROBENZENE	<26		
/ 1,4-DICHLOROBENZENE	460		
\ 1,3-DICHLOROBENZENE	-		

/ REPORTED VALUE
\ REPRESENTS TOTAL

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DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

DATE ISSUED 09/14/90

Stanley Treadwell
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006534

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B161

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP20003202-MS

REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<50		
BROMOMETHANE	<50		
VINYL CHLORIDE	<50		
CHLOROETHANE	<50		
METHYLENE CHLORIDE	<25		
TRICHLOROFLUOROMETHANE	<25		
1,1-DICHLOROETHENE	<25		
1,1-DICHLOROETHANE	<25		
C/T-1/2-DICHLOROETHENE	<25		
CHLOROFORM	<25		
1,2-DICHLOROETHANE	<25		
1,1,1-TRICHLOROETHANE	<25		
CARBON TETRACHLORIDE	<25		
BROMODICHLOROMETHANE	<25		
1,2-DICHLOROPROPANE	<25		
TRANS-1,3-DICHLOROPROPENE	<25		
TRICHLOROETHENE	<25		
DIBROMOCHLOROMETHANE	<25		
1,1,2-TRICHLOROETHANE	<25		
CIS-1,3-DICHLOROPROPENE	<25		
BENZENE	<25		
2-CHLOROETHYLVINYL ETHER	<50		
BROMOFORM	<25		
1,1,2,2-TETRACHLOROETHANE	<25		
TETRACHLOROETHENE	<25		
TOLUENE	<25		
CHLOROBENZENE	<25		
ETHYLBENZENE	<25		
1,2-DICHLOROBENZENE	<25		
1,3-DICHLOROBENZENE	<25		
1,4-DICHLOROBENZENE	<25		

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DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006535

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B162

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP20003202-MSD

REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<48		
BROMOMETHANE	<48		
VINYL CHLORIDE	<48		
CHLOROETHANE	<48		
METHYLENE CHLORIDE	<24		
TRICHLOROFLUOROMETHANE	<24		
1,1-DICHLOROETHENE	<24		
1,1-DICHLOROETHANE	<24		
C/T-1/2-DICHLOROETHENE	<24		
CHLOROFORM	<24		
1,2-DICHLOROETHANE	<24		
1,1,1-TRICHLOROETHANE	<24		
CARBON TETRACHLORIDE	<24		
BROMODICHLOROMETHANE	<24		
1,2-DICHLOROPROPANE	<24		
TRANS-1,3-DICHLOROPROPENE	<24		
TRICHLOROETHENE	<24		
DIBROMOCHLOROMETHANE	<24		
1,1,2-TRICHLOROETHANE	<24		
CIS-1,3-DICHLOROPROPENE	<24		
BENZENE	<24		
2-CHLOROETHYLVINYL ETHER	<48		
BROMOFORM	<24		
1,1,2,2-TETRACHLOROETHANE	<24		
TETRACHLOROETHENE	<24		
TOLUENE	<24		
CHLOROBENZENE	<24		
ETHYLBENZENE	<24		
1,2-DICHLOROBENZENE	<24		
1,3-DICHLOROBENZENE	<24		
1,4-DICHLOROBENZENE	<24		

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DATE ISSUED 09/10/90

DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759056
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2F81000312 Tube B137
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
Trichlorofluoromethane		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
2-Chloroethylvinyl Ether	1)	ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
1,2-Dichlorobenzene		ND
1,3-Dichlorobenzene		ND
1,4-Dichlorobenzene		ND
Acetone		200
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 30 ug/m3

ND - Under Quantification Lim

1) Quantification limit: 59 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/05/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006531

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B167

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2FB20003202
FIELD BLANK
REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<50		
BROMOMETHANE	<50		
VINYL CHLORIDE	<50		
CHLOROETHANE	<50		
METHYLENE CHLORIDE	<25		
TRICHLOROFLUOROMETHANE	<25		
1,1-DICHLOROETHENE	<25		
1,1-DICHLOROETHANE	<25		
C/T-1/2-DICHLOROETHENE	<25		
CHLOROFORM	<25		
1,2-DICHLOROETHANE	<25		
1,1,1-TRICHLOROETHANE	<25		
CARBON TETRACHLORIDE	<25		
BROMODICHLOROMETHANE	<25		
1,2-DICHLOROPROPANE	<25		
TRANS-1,3-DICHLOROPROPENE	<25		
TRICHLOROETHENE	<25		
DIBROMOCHLOROMETHANE	<25		
1,1,2-TRICHLOROETHANE	<25		
CIS-1,3-DICHLOROPROPENE	<25		
BENZENE	<25		
2-CHLOROETHYLVINYL ETHER	<50		
BROMOFORM	<25		
1,1,2,2-TETRACHLOROETHANE	<25		
TETRACHLOROETHENE	<25		
TOLUENE	<25		
CHLOROBENZENE	<25		
ETHYLBENZENE	<25		
1,2-DICHLOROBENZENE	<25		
1,3-DICHLOROBENZENE	<25		
1,4-DICHLOROBENZENE	<25		

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DATE ISSUED 09/10/90

DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

Stanley Freedman
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759057
Date Collected: 5/19/90
Date Received: 5/21/90
Type: Miscellaneous
Point: Air Samples Job#IPSR-8901
IP0A2TB1000312 Tube 8119
Collected By: CP 03

TARGET COMPOUND LIST PURGEABLES

Compound		ug/m3
Chloromethane	1)	ND
Bromomethane	1)	ND
Vinyl Chloride	1)	ND
Chloroethane	1)	ND
Methylene Chloride		ND
1,1-Dichloroethene		ND
1,1-Dichloroethane		ND
cis/trans-1,2-Dichloroethene		ND
Chloroform		ND
1,2-Dichloroethane		ND
1,1,1,-Trichloroethane		ND
Carbon Tetrachloride		ND
Bromodichloromethane		ND
1,2-Dichloropropane		ND
trans-1,3-Dichloropropene		ND
Trichloroethene		ND
Dibromochloromethane		ND
1,1,2-Trichloroethane		ND
cis-1,3-Dichloropropene		ND
Benzene		ND
Bromoform		ND
1,1,2,2-Tetrachloroethane		ND
Tetrachloroethene		ND
Toluene		ND
Chlorobenzene		ND
Ethylbenzene		ND
Acetone		ND
Carbon disulfide		ND
2-Butanone (MEK)	1)	ND
Vinyl Acetate	1)	ND
2-Hexanone	1)	ND
4-Methyl-2-Pentanone	1)	ND
Styrene		ND
Xylenes		ND

Quantification limit: 25 ug/m3

ND - Under Quantification Limit

1) Quantification limit: 50 ug/m3

Date Analyzed: 5/22/90
Date Reported: 6/01/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006538

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

TUBE NO... B166

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2TB20003202
TRIP BLANK
REMARKS: INDUSTRIPLEX SITE SAMPLE

PURGEABLE ORGANICS - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
CHLOROMETHANE	<50		
BROMOMETHANE	<50		
VINYL CHLORIDE	<50		
CHLOROETHANE	<50		
METHYLENE CHLORIDE	<25		
TRICHLOROFLUOROMETHANE	<25		
1,1-DICHLOROETHENE	<25		
1,1-DICHLOROETHANE	<25		
C/T-1/2-DICHLOROETHENE	<25		
CHLOROFORM	<25		
1,2-DICHLOROETHANE	<25		
1,1,1-TRICHLOROETHANE	<25		
CARBON TETRACHLORIDE	<25		
BROMODICHLOROMETHANE	<25		
1,2-DICHLOROPROPANE	<25		
TRANS-1,3-DICHLOROPROPENE	<25		
TRICHLOROETHENE	<25		
DIBROMOCHLOROMETHANE	<25		
1,1,2-TRICHLOROETHANE	<25		
CIS-1,3-DICHLOROPROPENE	<25		
BENZENE	<25		
2-CHLOROETHYLVINYL ETHER	<50		
BROMOFORM	<25		
1,1,2,2-TETRACHLOROETHANE	<25		
TETRACHLOROETHENE	<25		
TOLUENE	<25		
CHLOROBENZENE	<25		
ETHYLBENZENE	<25		
1,2-DICHLOROBENZENE	<25		
1,3-DICHLOROBENZENE	<25		
1,4-DICHLOROBENZENE	<25		

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DATE ISSUED 09/10/90

DATE RUN..... 08/28/90
DATE REPORTED.. 09/07/90

Stanley Isaacson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

STV ASSOCIATES
11 ROBINSON ST.
POTTSDAM, PA 19464

Sample Lab No. Mounting Blank
Date Collected: --/--/--
Date Received: --/--/--
Type: MOUNTING BLANK
Collected By: ----

VOLATILE ORGANICS

Compound	ug/m³
Chloromethane	< 50
Bromomethane	< 50
Vinyl Chloride	< 50
Chloroethane	< 50
Methylene Chloride	< 25
Trichlorofluoromethane	< 25
1,1-Dichloroethene	< 25
1,1-Dichloroethane	< 25
cis/trans-1,2-Dichloroethene	< 25
Chloroform	< 25
1,2-Dichloroethane	< 25
1,1,1-Trichloroethane	< 25
Carbon Tetrachloride	< 25
Bromodichloromethane	< 25
1,2-Dichloropropane	< 25
trans-1,3-Dichloropropane	< 25
Trichloroethene	< 25
Chlorodibromomethane	< 25
1,1,2-Trichloroethane	< 25
cis-1,3-Dichloropropene	< 25
Bromoform	< 25
2-chloroethylvinyl ether	< 50
Tetrachloroethene	< 25
1,1,2,2-Tetrachloroethane	< 25
Chlorobenzene	< 25
1,3-Dichlorobenzene	< 25
1,4-Dichlorobenzene	< 25
1,2-Dichlorobenzene	< 25
Benzene	< 25
Toluene	< 25
Ethylbenzene	< 25

Date Analyzed: 5/22/90
Date Reported: 10/25/90

John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

STV ASSOCIATES
11 ROBINSON ST.
POTTSDAM, PA 19464

Sample Lab No. Mounting Blank
Date Collected: --/--/--
Date Received: --/--/--
Type: MOUNTING BLANK
Collected By: ----

VOLATILE ORGANICS

Compound	ug/m³
Chloromethane	< 50
Bromomethane	< 50
Vinyl Chloride	< 50
Chloroethane	< 50
Methylene Chloride	< 25
Trichlorofluoromethane	< 25
1,1-Dichloroethene	< 25
1,1-Dichloroethane	< 25
cis/trans-1,2-Dichloroethene	< 25
Chloroform	< 25
1,2-Dichloroethane	< 25
1,1,1-Trichloroethane	< 25
Carbon Tetrachloride	< 25
Bromodichloromethane	< 25
1,2-Dichloropropane	< 25
trans-1,3-Dichloropropane	< 25
Trichloroethene	< 25
Chlorodibromomethane	< 25
1,1,2-Trichloroethane	< 25
cis-1,3-Dichloropropene	< 25
Bromoform	< 25
2-chloroethylvinyl ether	< 50
Tetrachloroethene	< 25
1,1,2,2-Tetrachloroethane	< 25
Chlorobenzene	< 25
1,3-Dichlorobenzene	< 25
1,4-Dichlorobenzene	< 25
1,2-Dichlorobenzene	< 25
Benzene	< 25
Toluene	< 25
Ethylbenzene	< 25

Date Analyzed: 8/28/90
Date Reported: 10/18/88

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

3A

WATER VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: H2M LABS, INC. Contract: _____

Lab Code: H2MLABS Case No: _____ SAS No: _____ SDG No:

Matrix Spike - Sample No.: 9006534 - (B-161)

COMPOUND	SPIKE ADDED ng	SAMPLE CONCENTRATION ng	MS CONCENTRATION ng	MS % REC #	QC LIMITS REC.
1,1-Dichloroethene	250	0	129	52	61-145
Trichloroethene	250	0	269	108	71-120
Benzene	250	0	217	87	76-127
Toluene	250	0	265	106	76-125
Chlorobenzene	250	0	289	116	75-130

COMPOUND	SPIKE ADDED ng	MSD CONCENTRATION ng	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
1,1-Dichloroethene	250	129	52	0	14	61-145
Trichloroethene	250	263	105	2	14	71-120
Benzene	250	231	92	6	11	76-127
Toluene	250	271	108	2	13	76-125
Chlorobenzene	250	272	109	6	13	75-130

Column to be used to flag recovery and RPD values with an asterisk

RPD: 0 out of 5 outside limits
Spike Recovery: 2 out of 10 outside limits

Comments: _____

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759015
Date Collected: 5-18-90
Date Received: 5-19-90
Type: Miscellaneous
Point: Air Sample #IP0A2HP3000317
100.5 LTRS Job#IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 12 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759036
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample - 30 Hrs.
IP0A2HP1000317 Job#IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

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(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759037
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample IP0A2HP2000317
Job#IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759039
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample IPOA2HP4000317
Job# IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759040
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample IP0A2HP7000317
Job# IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759041
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample IPOA2HP9000317
Job# IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

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*
* JM Molloy *
****

John J. Molloy, P.E.
Laboratory Director

LAB NO: 9006526

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP20003207
MS/MSD ALSO
REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

METHYL MERCAPTAN - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHYL MERCAPTAN	<83		

COPIES TO: CP

DATE ISSUED 09/10/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/07/90

Stanley Pearson
LABORATORY DIRECTOR

CP

LAB NO: 9006363

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP70003207

REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBURN,MASS.

METHYL MERCAPTAN - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHYL MERCAPTAN	<63		

COPIES TO: CP

DATE ISSUED 09/10/9(

DATE RUN..... 08/27/90
DATE REPORTED.. 09/07/90

Stanley Pearson
LABORATORY DIRECTOR

CP

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006527

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003607

REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

METHYL MERCAPTAN - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHYL MERCAPTAN	<370		

COPIES TO: CP

DATE ISSUED 09/14/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/07/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759038
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample IP0A2HP2000317 Dup.
Job#IPSR-8901
Collected By: CP 03

ANALYTICAL RESULTS

Compound	ug/m3
methyl mercaptan.	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed: 5-29-90
Date Reported: 6-05-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006528

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003607
DUPLICATE
REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

METHYL MERCAPTAN - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHYL MERCAPTAN	<370		

COPIES TO: CP

DATE ISSUED 09/14/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/07/90

Stanley Isaacson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759042
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: Air Sample IP0A2FB1000317
Job# IPSR-8901
Collected By: CP 03

METHYL MERCAPTAN

Compound	ug/m3
methyl mercaptan	ND

Quantification limit: 42 ug/m3

ND-Under quantification limit

Date Extracted: 5-24-90
Date Analyzed : 5-29-90
Date Reported : 6-05-90

John J. Molloy, P.E.
Laboratory Director

(516)694-3040 FAX:(516)694-4122

LAB NO: 9006364

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2FB20003206
FIELD BLANK
REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBURN,MASS.

METHYL MERCAPTAN - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHYL MERCAPTAN	<63		

COPIES TO: CP

DATE ISSUED 09/10/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/07/90

Stanley Pearson
LABORATORY DIRECTOR

CP

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006529

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2TB20003207
TRIP BLANK
REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

METHYL MERCAPTAN - (ug/m3)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHYL MERCAPTAN	<63		

COPIES TO: CP

DATE ISSUED 09/10/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/07/90

Stanley Pearson
LABORATORY DIRECTOR

CP

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

STV ASSOCIATES
11 ROBINSON ST.
POTTSDAM, PA 19464

Sample Lab No. Instr. Blank
Date Collected:--/--/--
Date Received:--/--/--
Type: INSTRUMENT BLANK
Collected By: ----

METHYL MERCAPTAIN

Compound	mg/m³
Methyl Mercaptain	< 62.5

Date Analyzed: 05/24/90
Date Reported: 10/25/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

STV ASSOCIATES
11 ROBINSON ST.
POTTSDAM, PA 19464

Sample Lab No. Instr. Blank
Date Collected:--/--/--
Date Received:--/--/--
Type: INSTRUMENT BLANK
Collected By: ----

METHYL MERCAPTAIN

Compound	ug/m^3
Methyl Mercaptain	< 63

Date Analyzed: 08/27/90
Date Reported: 10/11/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

3A

VOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: H2M LABS, INC. Contract: _____

Lab Code: H2MLABS Case No: _____ SAS No: _____ SDG No:

Matrix Spike - Sample No.: 9006526

COMPOUND	SPIKE ADDED ng	SAMPLE CONCENTRATION ng	MS CONCENTRATION ng	MS % REC #	QC LIMITS REC.
					61-145
					71-120
					76-127
					76-125
					75-130
Methyl Mercaptan	53.5	0	49.09	92	

COMPOUND	SPIKE ADDED ng	MSD CONCENTRATION ng	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
					14	61-145
					14	71-120
					11	76-127
					13	76-125
					13	75-130
Methyl Mercaptan	53.5	51.51	96	5		

Column to be used to flag recovery and RPD values with an asterisk
*
* Values outside of QC limits due to high level of compound in sample.

RPD: _____ out of _____ outside limits
Spike Recovery: _____ out of _____ outside limits

Comments: _____

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

INDUSTRI-PLEX SITE
STV ASSOCIATES
INORGANIC PARAMETERS

SAMPLE GROUP	COLLECTED	DATE REC'D	ANALYTE	DATE RUN
759030 - 035	5/19/90	5/21/90	SULFIDE	5/21/90

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

INDUSTRI-PLEX SITE
STV ASSOCIATES
INORGANIC PARAMETERS

SAMPLE GROUP	COLLECTED	DATE REC'D	ANALYTE	DATE RUN
9006350 - 352	8/21/90	8/22/90	SULFIDE	8/22/90
9006539 - 542	8/22/90	8/22/90	SULFIDE	8/22/90

H2M LABS, INC.
Environmental Testing Laboratories
575 Broad Hollow Road, Melville, New York 11747-5076 • (516) 694-3040

Water/Waste Water Laboratory • Hazardous Waste Laboratory • Air Testing Laboratory
Pilot Plant Studies and Other Analytical Services

LABORATORY REPORT

LAB NO. 759030
PROJECT NO. IPSR 8901

CLIENT'S NAME AND ADDRESS

INDUSTRIPLEX

TYPE OF SAMPLE - AIR
DATE COLLECTED - 5/19/90

AIR SAMPLE
48 HRS.

COLLECTED BY CP 03
DATE RECEIVED - 5/21/90

LAB NO.	SAMPLE ID INFORMATION	SULFIDE (PPMV)
759030	IPOA2HP2000316	<0.031
759031	IPOA2HP2000316 DUP	<0.031
759032	IPOA2HP4000316	<0.031
759033	IPOA2HP7000316	0.251
759034	IPOA2HP9000316	<0.031
759035	IPOA2HPFB1000316	<0.031

REMARKS - BILLS & REPORTS: CP

DATE REPORTED 5/22/90

LABORATORY DIRECTOR

H2M LABS, INC.
Environmental Testing Laboratories
575 Broad Hollow Road, Melville, New York 11747-5076 • (516) 694-3040

Water/Waste Water Laboratory • Hazardous Waste Laboratory • Air Testing Laboratory
Pilot Plant Studies and Other Analytical Services

LABORATORY REPORT

CLIENT'S NAME AND ADDRESS	
INDUSTRIPLEX	TYPE OF SAMPLE - AIR DATE COLLECTED - 5/18/90 AIR SAMPLES

COLLECTED BY CP 03
DATE RECEIVED - 5/19/90

LAB NO.	SAMPLE ID INFORMATION	SULFIDE
759012	IPOA2HP1000316 30 LITERS	<0.047 ppmv
759013	IPOA2HP3000316 180 LITERS	<0.008 ppmv
759014	IPOA2TB1000316	<148 ppb

REMARKS - BILLS & REPORTS: CP

DATE REPORTED 5/29/90

LABORATORY DIRECTOR

HZM LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006351

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOAHP70003206

REMARKS: INDUSTRIPLEX SITE
WOBURN,MASS.

PARAMETER (S)	RESULTS	UNITS
SULFIDE	0.035	PPM

COPIES TO: CP

DATE ISSUED 08/30/90

Stanley Pearson
LABORATORY DIRECTOR

CP

(516)694-3040 FAX:(516)694-4122

LAB NO: 9006350

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP20003206
MS/MSD ALSO
REMARKS: INDUSTRIPLEX SITE
WOBURN,MASS.

PARAMETER (S)	RESULTS	UNITS
SULFIDE	0.027	PPM

COPIES TO: CP

DATE ISSUED 08/30/90

Stanley Isaacson
LABORATORY DIRECTOR

CP

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006539

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003206

REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

PARAMETER (S)	RESULTS	UNITS
SULFIDE	2760	PPM

COPIES TO: CP

DATE ISSUED 09/04/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006540

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003206-DUP

REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

PARAMETER (S)	RESULTS	UNITS
SULFIDE	2890	PPM

COPIES TO: CP

DATE ISSUED 09/04/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

HZM LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006352

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2FB20003206
FIELD BLANK
REMARKS: INDUSTRIPLEX SITE
WOBURN,MASS.

PARAMETER (S)	RESULTS	UNITS
SULFIDE	<0.027	PPM

COPIES TO: CP

DATE ISSUED 08/30/90

Stanley Treaster
LABORATORY DIRECTOR

CP

(516)694-3040 FAX:(516)694-4122

LAB NO: 9006542

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2TB20003206
TRIP BLANK
REMARKS: INDUSTRIPLEX SITE SAMPLE
WOBORN,MASS.

PARAMETER (S)	RESULTS	UNITS
SULFIDE	<0.27	MG/L

COPIES TO: CP

DATE ISSUED 08/30/90

Stanley Pearson
LABORATORY DIRECTOR

CP

H2M LABS INC

WET CHEM Q.C. SUMMARY

CLIENT ID NO. INDUSTRI-PLEX SITE

LAB NO. 759036 - 759042 DATE RECEIVED 5/21/90

UNITS ppm MATRIX AIR

ANALYTE	BLANK	SPIKED SAMPLE RESULT	SPIKE ADDED	SAMPLE RESULT	PERCENT RECOVERY	INITIAL SAMPLE RESULT	DUPLICATE SAMPLE RESULT	RPD	H2M LAB. NO. OF SAMPLE USED FOR MS/MSD
S	<0.031*	---	---	---	---	---	---	---	------

* = Assumes a volume of 45 liters

H2M LABS INC

WET CHEM Q.C. SUMMARY

CLIENT ID NO. INSDUTRI-PLEX SITE

LAB NO. 9006350 - 9006352 DATE RECEIVED 8/22/90

UNITS ppm MATRIX AIR

ANALYTE	BLANK	SPIKED SAMPLE RESULT	SPIKE ADDED	SAMPLE RESULT	PERCENT RECOVERY	INITIAL SAMPLE RESULT	DUPLICATE SAMPLE RESULT	RPD	H2M LAB. NO. OF SAMPLE USED FOR MS/MSD
S	< 0.027	0.050	0.027	0.027	85.2	0.027	0.027	0.0	9006350

H2M LABS INC

WET CHEM Q.C. SUMMARY

CLIENT ID NO. INDUSTRI-PLEX SITE

LAB NO. 9006526 - 9006542 DATE RECEIVED 8/22/90

UNITS ppm MATRIX AIR

ANALYTE	BLANK	SPIKED SAMPLE RESULT	SPIKE ADDED	SAMPLE RESULT	PERCENT RECOVERY	INITIAL SAMPLE RESULT	DUPLICATE SAMPLE RESULT	RPD	H2M LAB. NO. OF SAMPLE USED FOR MS/MSD
S	< 3.00	3570	899	2894	75.2	2890	2760	4.6	9006540

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759016
Date Collected: 5-18-90
Date Received: 5-19-90
Point: IPOA2HP100318 1 HR.
Collected By: CP 03

ANALYTICAL RESULTS

Compound	mg/l (ppm)
methane.	< 4

Date Reported: 5-23-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759017
Date Collected: 5-18-90
Date Received: 5-19-90
Point: IPOA2HP3000318 1 HR.
Collected By: CP 03

ANALYTICAL RESULTS

Compound	mg/l
methane.	< 4

Date Reported: 5-23-90

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John J. Molloy, P.E.
Laboratory Director

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(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759044
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: IPOA2HP2000318
Collected By: CP 03

ANALYTICAL RESULTS

Compound	ppmv
methane.	760

Date Reported: 5-24-90

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John J. Molloy, P.E.
Laboratory Director

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575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759045
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: IPOA2HP4000318
Collected By: CP 03

ANALYTICAL RESULTS

Compound	ppmv
methane.	8.3

Date Reported: 5-24-90

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John J. Molloy, P.E.
Laboratory Director

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ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759046
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: IPOA2HP7000318
Collected By: CP 03

ANALYTICAL RESULTS

Compound	ppmv
methane.	9.2

Date Reported: 5-24-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759047
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: IPOA2HP9000318
Collected By: CP 03

ANALYTICAL RESULTS

Compound	ppmv
methane.	38

Date Reported: 5-24-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006879

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP20003208
MS/MSD ALSO
REMARKS: INDUDTRIPLEX SITE SAMPLES
WOBURN,MASS.

METHANE - (PPM)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHANE	7.3		

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DATE RUN..... 08/27/90
DATE REPORTED.. 09/14/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006880

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2HP70003208

REMARKS: INDUDTRIPLEX SITE SAMPLES
WOBURN,MASS.

METHANE - (PPM)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHANE	5.5		

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DATE RUN..... 08/27/90
DATE REPORTED.. 09/14/90

LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006881

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/21/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2FB20003208
FIELD BLANK
REMARKS: INDUDTRIPLEX SITE SAMPLES
WOBURN,MASS.

METHANE - (PPM)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHANE	<5		

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DATE ISSUED 09/14/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/14/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.

575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122

ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No. 759043
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: IPOA2HP2000318 Dup.
Collected By: CL 03

ANALYTICAL RESULTS

Compound	ppmv
methane	< 4

Date Extracted: 5-19-90
Date Analyzed: 5-21-90
Date Reported: 5-24-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006882

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003208

REMARKS: INDUDTRIPLEX SITE SAMPLES
WOBURN,MASS.

METHANE - (PPM)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHANE	240000		

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DATE RUN..... 08/27/90
DATE REPORTED.. 09/14/90

Stanley Isaacson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

Industriplex

Sample Lab No.: 759048
Date Collected: 5-19-90
Date Received: 5-21-90
Type: Miscellaneous
Point: IPOA2FB1000318
Collected By: Cp 03

ANALYTICAL RESULTS

Compound	ppmv
methane.	< 4

Date Reported: 5-24-90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006883

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2B100003208-DUP
REMARKS: INDUDTRIPLEX SITE SAMPLES
WOBURN,MASS.

METHANE - (PPM)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHANE	110000		

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DATE RUN..... 08/27/90
DATE REPORTED.. 09/14/90

Stanley Isaacson
LABORATORY DIRECTOR

ORIGINAL

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516)694-3040 FAX:(516)694-4122

LAB NO: 9006884

STY ASSOCCIATES
JOHN MARMO
11 ROBINSON ST.
POTTSDAM, PA 19464

TYPE..... AIR

DATE COLLECTED. 08/22/90
DATE RECEIVED.. 08/22/90
COLLECTED BY... CJF 03
PROJECT NO..... IPSR8901

POINT NO:
LOCATION: IPOA2TB20003208
TRIP BLANK
REMARKS: INDUDTRIPLEX SITE SAMPLES
WOBURN,MASS.

METHANE - (PPM)

PARAMETER (S)	RESULT	PARAMETER (S)	RESULT
METHANE	<5		

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DATE ISSUED 09/14/90

DATE RUN..... 08/27/90
DATE REPORTED.. 09/14/90

Stanley Pearson
LABORATORY DIRECTOR

ORIGINAL

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575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

STV ASSOCIATES
11 ROBINSON ST.
POTTSDAM, PA 19464

Sample Lab No. Instr. Blank
Date Collected:--/--/--
Date Received:--/--/--
Type: INSTRUMENT BLANK
Collected By: ----

METHANE ANALYSIS

Compound	mg/l
Methane	< 4

Date Analyzed: 05/19/90
Date Reported: 10/25/90

John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

STV ASSOCIATES
11 ROBINSON ST.
POTTSDAM, PA 19464

Sample Lab No. Instr. Blank
Date Collected:--/--/--
Date Received:--/--/--
Type: INSTRUMENT BLANK
Collected By: ----

METHANE ANALYSIS

Compound	mg/l
Methane	< 5

Date Analyzed: 08/27/90
Date Reported: 10/22/90

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John J. Molloy, P.E.
Laboratory Director

H2M LABS, INC.
575 Broad Hollow Road, Melville, N.Y. 11747
(516) 694-3040 FAX: (516) 694-4122
ENVIRONMENTAL and INDUSTRIAL ANALYTICAL LABORATORY

SPIKE/SPIKE DUPLICATE RECOVERY

Lab Name: H2M LABS, INC. Contract:

QC Spike or Sample No.: IPOA2HP20003208 Level:
9006879

Compound	SPIKE ADDED (ug/L)	SAMPLE CONC. (ug/L)	MS CONC. (ug/L)	MS REC %	#	MSD CONC. (ug/L)	MSD REC %	#	RPD %	#	QC LIMITS % REC
METHANE	19.8	7.3	27.4	101		25.5	92		9		75-125